QUALITY ASSURANCE PROJECT PLAN

FOR THE PHASE I RCRA FACILITY INVESTIGATION AT

E.I. DU PONT DE NEMOURS AND COMPANY'S

CHEMICAL MANUFACTURING PLANT IN EAST CHICAGO, INDIANA

US EPA ID NUMBER IND 005 174 254

REVISION 1

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TABLE OF CONTENTS

Page

Page

Page

Page

Page

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

Attachment No.	Description
D1	Data Quality Objectives
D2	Lancaster Laboratories Training SOPs and Example Documentation Forms
D3	Lancaster Laboratories Volatiles Preparation and Analysis SOPs
D4	Lancaster Laboratories Semivolatiles Preparation, Cleanup, and Analysis SOPs
D5	Lancaster Laboratories Organochlorine Pesticide/PCB and PCB only Preparation, Cleanup, and Analysis SOPs
D6	Lancaster Laboratories Organochlorine Herbicide Preparation and Analysis SOPs
D7	Lancaster Laboratories General Gas Chromatography SOPs
D8	Lancaster Laboratories Metals Preparation and Inductively Coupled Plasma (ICP trace) Analysis SOPs
D9	Lancaster Laboratories Mercury Preparation and Analysis SOPs
D10	Lancaster Laboratories Wet Chemistry Preparation and Analysis SOPs
D11	Lancaster Laboratories Internal Chain-of-Custody Documentation SOP
D12	Lancaster Laboratories Analytical Method Validation and Method Detection Limit Determination SOPs
D13	Geotechnical Testing Methods
D14	Data Validation SOPs
D15	Lancaster Laboratories Example Reporting Forms
D16	Field Audit Checklist
D17	Lancaster Laboratories Audit Checklist
D18	Lancaster Laboratories Performance Evaluation Results
D19	Lancaster Laboratories Supplies and Consumables SOPs

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SECTION 1

PROJECT DESCRIPTION

1.0 Project Description

The E.I. du Pont de Nemours and Company (DuPont) has entered into an agreement with the US Environmental Protection Agency (US EPA) pursuant to Resource Conservation and Recovery Act (RCRA) Corrective Action Order (Order) IND 005 174 254 (US EPA 1997), dated June 25, 1997, to conduct a RCRA Facility Investigation (RFI) at DuPont's East Chicago Facility. This document presents the quality assurance project plan (QAPP) for the Phase I RFI. The Phase I RFI will be completed in a phased approach to allow for the collection of data in a logical and scientific manner.

This QAPP is an integral part of the approved "Phase I RFI Work Plan, East Chicago Facility, East Chicago, Indiana" (Phase I RFI Work Plan, May 26, 1999). This QAPP presents the organization, objectives, planned activities, and specific quality assurance (QA)/quality control (QC) procedures associated with the Phase I RFI for the DuPont East Chicago Facility. Specific protocols for sampling, sample handling and storage, Chain-of-Custody, and laboratory and field analyses will be described. All QA/QC procedures will be structured in accordance with applicable US EPA requirements, regulations, guidance, and technical standards. This QAPP was prepared in accordance with a guidance manual entitled "RCRA QAPP Instructions, U.S. EPA Region 5," Revision: April 1998.

1.1 Introduction

This QAPP has been prepared on behalf of DuPont by Environmental Standards, Inc. (Environmental Standards). DuPont previously submitted the "Current Conditions Report for the DuPont East Chicago Facility," prepared by CH2M Hill, under a separate cover on October 28, 1997. The Current Conditions Report (CCR) presented DuPont's understanding of site conditions based on a consolidation of existing information available for review, and the report should be considered entirely incorporated into the QAPP through specific reference. In addition, a Project Management Plan, a Field Sampling Plan (FSP), a Data Management Plan, a Health and Safety Plan, and a Public Involvement Plan are appended to the Phase I RFI Work Plan, prepared by the Woodward-Clyde Diamond Group (WCD). This QAPP has also been prepared to be entirely incorporated into the Phase I RFI Work Plan as Appendix E.

1.1.1 Overall Project Objectives and Decision Statements

The goal of this phase of the RFI is to characterize the release or potential for release from specific solid waste management units (SWMUs) and areas of concern (AOCs) and to assess the potential for adverse effects to human health and the environment as a result of releases from those units or areas. This information will be used to assist in developing a prioritized, risk-based approach to address the corrective action activities. It is anticipated that this approach will accelerate corrective action at the units that pose the greatest potential threat (rather than waiting until all facility SWMUs and AOCs have been characterized and associated releases, if present, have been delineated).

Specific objectives for the Phase I RFI are:

- To identify and characterize the release potential through the most likely exposure pathways at specific SWMUs and AOCs;
- To determine the priority of each SWMU and AOC for future corrective action activities; and
- To refine key aspects of the Preliminary Conceptual Facility Model.

The Decision Statement for this investigation is as follows: What are the nature and extent of the constituents presented in Table D1-1 in groundwater or soil/sediment at specific SWMUs and AOCs that present unacceptable risks, which would, therefore, warrant further investigation, corrective action, or reprioritization of the SWMUs or AOCs?

Associated specific objectives for field and laboratory data collection are tabulated in Section 1.4 of this QAPP.

1.1.2 Project Status/Phase

An integrated and phased approach will be used for the RFI. During the RFI, data collection will be conducted in phases. SWMUs and AOCs with the highest potential for impact to human health and the environment will be the focus of the Phase I RFI. The SWMUs and AOCs being investigated in the Phase I RFI were ranked "high" or "unknown" during a three-step prioritization process that involved the review of existing data with screening criteria, an evaluation of mitigating factors, and a comparative evaluation. The SWMUs and AOCs which

ranked "low" during the prioritization process will be addressed at a later, more appropriate time in the RFI program. The prioritization process and results are described in Sections 3.1 and 3.2 of the Phase I RFI Work Plan.

The Phase I field investigation will include the following activities:

- Sediment sampling at one SWMU, which was ranked "unknown (low)" for potential fire and explosion hazard and potential adverse effects on human health or the environment by release of constituents to air, if concentrations of organic compounds are present as determined by the use of a portable volatile organic vapor meter and an explosimeter.

- Surface soil (0-2 feet) sampling at SWMUs and AOCs ranked "high" or "unknown" for potential adverse effects on human health or the environment by release of constituents to air, by direct contact, or by surface water runoff.

- Subsurface soil (native, unsaturated soil between the unit or area and the water table or solid waste material above the water table) sampling at SWMUs and AOCs ranked "high" or "unknown" for potential release to subsurface soil and, potentially, to the groundwater flow system.

- Data collection to better characterize hydraulic conditions near the boundaries of three groundwater pools which were ranked "unknown" for potential adverse effects by groundwater discharge to surface water, and potential surface water collection based on an evaluation of this data.

- Collection of shelby tube samples from the top of the silty clay for laboratory analysis designed to determine hydraulic conductivity and to confirm the confining properties of the unit.

- Piezometric head measurement collection from all monitoring network locations and groundwater flow map development to develop a better understanding of the groundwater flow conditions and the hydraulic relationship between the surface water and shallow groundwater system at the facility.

- Four rounds of groundwater sampling from new and existing monitoring wells to gain a better understanding of existing groundwater quality conditions at the facility and of variations in target constituent concentrations over time.

- Collection of stratigraphic data during well, piezometer, and shelby tube installation in order to upgrade geological cross sections and to refine the groundwater flow conceptual model for the site.

Sediment, surface soil, subsurface soil, and groundwater samples will be collectively analyzed for the parameters listed in Table D1-1.

Data from the Phase I investigation will be qualitatively and quantitatively evaluated to determine if any further investigation or corrective action activities are necessary. A report will be prepared and submitted to the US EPA for review. This report will address at a minimum:

- The activities completed as part of the Phase I RFI;
- The rationale for any deviations from the procedures or methodologies specified in the Phase I RFI Work Plan;
- An evaluation of the data collected as part of this phase of the RFI in the form of tables, cross sections, maps, etc. with respect to releases and potential impacts to preliminary receptors and the Conceptual Facility Model (Section 2.4 of the Phase I RFI Work Plan);
- Conclusions regarding the presence or absence of suspected releases, as well as an evaluation of exposure pathways and preliminary receptors; and
- Recommendations, if necessary, for further investigation or corrective action activities and reprioritzation of the SWMUs or AOCs.

The rationale and scope of any Phase II investigation will be discussed with and approved by the US EPA prior to implementation.

1.1.3 QAPP Preparation Guidelines

The approved East Chicago Sediment Characterization Study (SCS) QAPP was modified to incorporate information relative to the Phase I RFI and to meet the requirements of the "RCRA QAPP Instructions, U.S. EPA Region 5," Revision: April 1998. Furthermore, a conference call was held with the US EPA in which the Region's protocol for preparation of QAPPs was discussed. Additional guidance was received during the conference call on how to prepare this

QAPP. This conference call was held instead of a formal "pre-QAPP" meeting because a pre-QAPP meeting had been conducted prior to the preparation of the SCS QAPP. For the conference call, representatives from the US EPA's Environmental Sciences Division were present and available for consultation with representatives of DuPont, WCD, and Environmental Standards. In August 1999, DuPont received comments on Revision 0 of the QAPP from US EPA Region 5. Representatives of DuPont, WCD, and Environmental Standards discussed responses to the comments made by the US EPA Region 5 in a conference call with representatives from US EPA Region 5, which were verbally approved by the US EPA Region 5. DuPont submitted written responses on the comments made by the US EPA Region 5 with Revision 1 of the QAPP. Revision 1 of the QAPP incorporates the changes to Sections 1, 4, 6, 7, and 9, Table DA1-3 of Attachment 1, and SOP AL-WET-34 of Attachment D10, discussed in the responses to the US EPA comments.

1.2 Site/Facility Description

A brief description of the facility, its geological setting, and associated features is presented in the section below.

1.2.1 Location

The DuPont East Chicago Facility is a chemical manufacturing plant located at 5215 Kennedy Avenue, East Chicago, Lake County, Indiana. The DuPont East Chicago Facility property is located along the East Branch of the Grand Calumet River (GCR) between Cline Avenue and Kennedy Avenue. Maps of the facility property are provided as Figures 2-1 and 2-2 of the Phase I RFI Work Plan. Development occurred primarily on the western part of the property. The southern part of the developed area was used for manufacturing purposes (the "primary manufacturing area"). The northwestern quadrant of the property and the eastern edge of the developed area were used for waste management purposes. The eastern part of the property (the "natural area") has not been developed.

1.2.2 Facility/Site Size and Borders

Of the 440 acres at the East Chicago Facility property owned by DuPont, roughly 430 acres are contiguous and constitute the "facility." The East Chicago Facility property is bounded on the west by Kennedy Avenue, on the north and northeast by the Indiana Harbor Belt Railroad, on the east by the Chicago South Shore and South Bend Railroad and a property owned by the City of East Chicago, and on the south by the East Branch of the GCR. The East Chicago Facility is one of hundreds of industrial facilities located within an industrial region defined by Lake Michigan

to the north, Interstate 94 to the south, the Indiana/Illinois border to the west, and the eastern edge of the City of Gary to the east.

Sections entitled "Regional and Site Development Overview" and "Surrounding Land Use" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-1 through 2-2). These sections of the CCR provide additional detail regarding the setting of the East Chicago Facility.

1.2.3 Natural and Man-made Features

Currently, the East Chicago facility comprises four main areas: (1) the active manufacturing area; (2) the previously active manufacturing area; (3) waste management areas outside the manufacturing areas; and (4) a natural area. These areas are illustrated on the surface of the three-dimensional representation of the facility depicted in Figure 2-8 of the Phase I RFI Work Plan.

Site development included regrading and construction of manufacturing buildings, utilities, and roadways. A significant part of the land surface within the manufacturing areas was compacted and paved during site development. Though all the aboveground facilities in this previously active manufacturing area have been removed, foundations, building rubble, and pavement can be seen on the land surface in many of the former operating areas. The land surface area within the active and previously active manufacturing areas and at almost all the waste management areas consists of fill of one kind or another. Limited vegetative cover or habitat has existed historically within the manufacturing and waste management areas of the facility. General refuse, wastewater treatment filter cake, process filter cake, ash, construction debris, and demolition debris were disposed of on land north of manufacturing operations. Only one landfill area remains active today. Vegetation is reestablishing itself over most of the inactive manufacturing and waste management areas. The original region consisted of a series of beach ridges separated by swales with many marshy areas. Within the natural area, a remnant ridge and swale (also referred to as dune and swale) community is present. One area in the southwestern part of the "natural area" is included as part of the waste management area in the model because of the presence of fill along the bank associated with channel relocation.

A chapter entitled "Facility Setting and Physical Characteristics" has been presented in the CCR (Chapter 2). In addition, a section entitled "Site Physical Conditions" has been presented in the Phase I RFI Work Plan (Section 2.4.1). This chapter of the CCR and this section of the Phase I RFI Work Plan provide additional detail regarding the physical characteristics of the East Chicago Facility.

1.2.4 Topography

Sections entitled "Regional Topography and Drainage" and "Site Topography and Drainage" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-2 through 2-4). These sections of the CCR provide information regarding the general topography of the East Chicago Facility property.

1.2.5 Local Hydrology and Hydrogeology

Sections entitled "Meterology and Surface Water Hydrology," "Hydrogeology," and "Regional Water Supply" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-3 through 2-4 and pg. 2-6 through 2-9). These sections of the CCR provide information regarding the local hydrology and hydrogeology of the East Chicago Facility property and surrounding region.

1.2.6 Surrounding Land Use

The East Chicago Facility property is bordered by a road, railroads, a property owned by the City of East Chicago, and the East Branch of the GCR. Beyond these features lie a U.S.S. Lead facility to the west; the Riley Park area to the north-northwest; a salvage yard and trucking operations to the north; petroleum storage facilities to the north-northeast; a former incinerator, a solid waste transfer station, and the East Chicago Central Services Center to the east; and Harbison-Walker Refractories and petroleum storage facilities to the south. Potential human receptors have been preliminarily identified and are addressed in Sections 2.4.4 ("Potential Human Receptors and Mitigating Factors") and 2.4.6 ("Summary of Potential Impacts") of the Phase I RFI Work Plan.

1.2.7 Ecological Communities and Habitats

Potential ecological receptors have been preliminarily identified and are addressed in Sections 2.4.5 ("Potential Ecological Receptors and Mitigating Factors") and 2.4.6 ("Summary of Potential Impacts") of the Phase I RFI Work Plan.

1.3 Site/Facility History

1.3.1 General History

The Grasselli Corporation established the facility in 1893 to manufacture inorganic chemicals. DuPont operated the facility for Grasselli from 1927-1936. In 1936, the facility was formally

deeded to DuPont, which has operated the facility since that time. The facility grew between 1893 and 1945 and occupied nearly 160 acres by 1930. Operations peaked around 1945 and began to decline after World War II. Manufacturing operations were limited to the western portion of the property (the eastern portion of the property was never developed). Manufacturing operations, including support activities, now cover 28 acres in the southwest corner of the site. The current work force is about 40 employees.

During its 105-year existence, the East Chicago Facility produced more than 100 products, consisting primarily of inorganic acids and chemicals (e.g., sulfuric, nitric, hydrochloric, phosphoric and fluorosulfonic acids); various chloride, ammonia, and zinc products; inorganic agricultural chemicals; trichlorofluoromethane (TCFM) or Freon® products; and several organic herbicides and insecticides (e.g., hexazinone). The facility now manufactures a colloidal silica product (Ludox®) and sodium silicate solution.

A chapter entitled "Facility Operations" is presented in the CCR (Chapter 3). This chapter of the CCR provides additional detail regarding the historic operations, describes the waste management practices, and identifies the SWMUs and AOCs of the East Chicago Facility. SWMUs and AOCs at the facility (Tables 2-2 and 2-3 in the Phase I RFI Work Plan) were identified using information contained in the CCR, historic aerial photographs, and clarification offered by DuPont personnel. The determination of whether an area is an SWMU or an AOC was based on information and definitions provided in the *Federal Register* for July 15, 1985, July 27, 1990, and May 1, 1996. The location and boundaries of the SWMUs and AOCs are illustrated in Figures 2-6a, 2-6b, 2-7a, and 2-7b in the Phase I RFI Work Plan. Brief descriptions of the SWMUs and AOCs are provided in Section 2.2 (SWMUs and AOCs) in the Phase I RFI Work Plan. Supplemental information, where available, is provided in the CCR.

1.3.2 Past Data Collection Activities

DuPont has conducted several environmental investigations of various media (soil, groundwater, and riverbank water) at the East Chicago Facility since 1983. These environmental investigations are described briefly in Table 4-1 of the CCR. The environmental media and analyte groups analyzed and the data quality level generated (primarily level IV) during these investigations are listed in Table 4-2 of the CCR. The analytes detected in the various environmental media are summarized in Table 4-3 of the CCR.

The primary analytes detected in environmental media at the facility were inorganic compounds, particularly major ions, water quality parameters, and common metals that occur naturally in the

environment (e.g., aluminum, calcium, carbonate, chloride, fluoride, iron, magnesium, sulfate). Several of these analytes are primary components of products made at the facility. Select trace metals (e.g., arsenic, barium, lead, and zinc) that were primary components of products are also present. Inorganic analytes present as trace components in products and waste streams (e.g., antimony, chromium) were also detected. In general, the distribution of these analytes is compatible with a history of inorganic chemical manufacturing. Organic compounds were rarely detected in environmental media at the facility. The only organic compound that has been detected in soil and groundwater at multiple locations in a discernible area is Freon®, which was detected in and near the former Freon® manufacturing area.

The frequency of detection and concentrations of these analytes in various environmental media is summarized in Tables 4-5 and 4-6, respectively, of the CCR. Although many of the detected analytes occur naturally in the environment, many were also components of products or waste streams at the facility, as summarized in Table 4-4 of the CCR.

A chapter entitled "Current Understanding of Environmental Quality Conditions" is presented in the CCR (Chapter 4). This chapter of the CCR provides an overview of the investigative activities conducted at the East Chicago Facility, summarizes available data quality data by medium and constituent groups, discusses data limitations, and describes the results of characterization work completed to date.

1.3.3 Current Status

1.3.3.1 Preliminary Conceptual Facility Model

The Preliminary Conceptual Facility Model (Chapter 5 of the CCR and Section 2.4 of the Phase I RFI Work Plan) will guide the overall RCRA Corrective Action Program at the East Chicago Facility. The model provides a basis for summarizing and visualizing the relationships between use of the land and constituents detected, human influence on the presence and distribution of constituents in environmental media, the spread and fate of constituents in the environment, and the potential effect of the constituents on the environment. The model provides an integrated representation of the most pertinent information available for the East Chicago Facility. The model consists of figures and tables, supplemented by text, that illustrate key concepts regarding:

- Site conditions that affect chemical mobility;
- The abundance and concentrations of detected constituents;

- Constituent fate and transport properties; and
- Known and potential migration pathways, potential receptors, and mitigating factors.

The model will be refined to reflect the knowledge of site conditions obtained from future supplemental evaluations, the subsequent RFI, or other associated RCRA corrective action activities. At this time, the model is incomplete. Information relating to the following topics will be needed to complete the model:

- The presence of releases at the SWMUs and AOCs;
- The characterization of releases (if present) at SWMUs or AOCs;
- The presence of completed migration pathways between known sources and potential receptors; and
- The concentration of constituents at points of exposure, as warranted.

1.3.3.2 Corrective Action Process

The corrective action process proposed for the East Chicago Facility is illustrated in Figure 3-1 of the Phase I RFI Work Plan. Historically, individual SWMUs and AOCs identified during the RCRA Facility Assessment (RFA) are investigated during the RFI phase of the corrective action process to characterize potential releases from the SWMUs and AOCs. As shown in Figure 3-1 of the Phase I RFI Work Plan, DuPont proposes to integrate risk management techniques into the corrective action process as an evaluation tool to prioritize the units for further investigation under the RFI. Establishing priorities using risk-based criteria will enable the RFI to focus on the units, areas, or releases that may pose the greatest potential for adverse effects on human health and the environment. This strategy is supported by the recent advanced notice of proposed rulemaking (ANPRM) for corrective action for releases from solid waste management units at hazardous waste management facilities (61 *Federal Register 19432*). The ANPRM promotes risk management concepts and decision-making to achieve results in addition to the continued use of the more process-oriented quantitative risk assessments.

1.3.3.3 Prioritization Process

Figure 3-2 of the Phase I RFI Work Plan illustrates the prioritization process concept used for the SWMUs/AOCs identified in Section 2.2 of the Phase I RFI Work Plan. Using risk assessment concepts to evaluate the potential for adverse effects and also existing site data (either environmental quality samples or manufacturing/process knowledge), the process identifies "high" or "low" rankings for various prioritization criteria. If the level of knowledge is insufficient for a unit or area, the alternative ranking of "unknown" is assigned. As additional information is gathered about the unit, area, or release, investigation priorities can be reevaluated. An important part of the prioritization process is an evaluation of the relationship between the potential for adverse effects exhibited by a unit or release from a unit and the level of knowledge (as well as the confidence in that knowledge) about the environmental status of the unit.

The prioritization evaluation process is a three-step effort. The first step is a quantifiable comparison of existing data against appropriate screening values. This step is discussed in further detail in Section 3.1.1 of the Phase I RFI Work Plan. The next step is a qualitative evaluation of mitigating factors that can offset or enhance the results from the first evaluation step. This step is discussed in further detail in Section 3.1.2 of the Phase I RFI Work Plan. These two steps are conducted on all potentially releasing units or areas at the facility for the following criteria:

- Potential fire or explosion hazard
- Potential release to air
- Potential direct contact
- Potential release to groundwater
- Potential release to surface water

Figures 3-3a through 3-3f in the Phase I RFI Work Plan provide flow charts depicting the logic used to complete the prioritization process for each criterion. The third step in the prioritization evaluation process is a comparative review of all identified concerns resulting from the first two steps in relation to each other. This step is discussed further in Section 3.1.3 of the Phase I RFI Work Plan.

The findings from the prioritization effort are used to identify the potential releases from SWMUs and AOCs and exposure pathways that are to be the focus of the next investigation effort at the facility. Units or areas that exhibit high potential for adverse effects and units with the least amount of information related to their release potential are usually considered high priority for further investigation. If a unit or area exhibits a low potential, a low priority or no further action ranking can be assigned. A low priority unit or area will be addressed at a later, more appropriate time in the RFI program. The prioritization process is not a one-time event like an historical baseline risk assessment, but an ongoing iterative process. Over time more information is gathered, the rankings can be revised, and investigation priorities can be reevaluated and changed, if appropriate.

1.3.3.4 Prioritization Results for the Phase I RFI

To establish investigation priorities at the East Chicago Facility, the SWMUs and AOCs identified in the CCR were ranked using the process described in the previous section. Upon completion of Steps 1 and 2, individual SWMU and AOC prioritization worksheets were completed (see Appendix B of the Phase I RFI Work Plan). These worksheets were critical to establishing the investigation priorities proposed in Section 3.3 of the Phase I RFI Work Plan.

Data used to complete the worksheets were obtained from:

- CCR (CH2M HILL 1997)
- "Phase I Groundwater Assessment, East Chicago Plant, East Chicago, Indiana" (CH2M HILL 1990)
- "Phase II Groundwater Assessment, East Chicago Plant, East Chicago, Indiana" (CH2M HILL 1991)
- Phase III Assessment Project Files (DuPont 1992-1994)
- Aerial photographs (1927, 1939, 1949, 1958, 1961, 1964, 1970, 1973, 1975, 1980, 1985, 1990)
- Interviews with DuPont employees

As shown in the process flow sheets, the first step was to compare existing environmental quality data to available and pertinent screening tools. The evaluation tools used for the prioritization evaluation were:

- **Fire or Explosion Hazard**—Comparison of observed concentrations for RCRA ignitable wastes or volatile organic compounds with flash points <140°F to threshold concentrations greater than 1 percent;

- **Release to Air**—Comparison of soil samples to State of Illinois "Tiered Approach to Corrective Action Objectives (TACO) Table 1: Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties";

- **Direct Contact**—Comparison of soil sample to the US EPA Region 9 Preliminary Remediation Goals (PRGs) for industrial soil, and to dermal contact-specific PRGs calculated from formulas provided by the US EPA Region 9;

- **Release to Groundwater**—Comparison of soil and groundwater samples to Table 14, "Surface Soil and Non-Residential Groundwater Criteria," in IDEM's *Voluntary Remediation Program Resource Guide* (July 1996) and to the industrial values in Table A of the "Risk Integrated System of Closure, Technical Resource Guidance Document, Interim Draft" (IDEM, 1999); and

- **Release to Surface Water**—Comparison of shallow groundwater samples to Table 2, "ETs for Surface Water Quality," in the US EPA's *EcoUpdate*: Ecotox Thresholds for Surface Water Quality (January 1996).

If environmental quality data for a unit were unavailable, the screening step was not completed. When screening values were not exceeded, a ranking of "low" or "no further action" was assigned. If the screening values were exceeded or if the initial screening step could not be performed, the unit or area was evaluated further for mitigating factors and a ranking of high, low, no further action, or unknown was assigned.

Units or areas with criteria ranked as either high or unknown are considered to have the highest potential for impact to human health and the environment. As such, these are the focus of the Phase I RFI. The units/areas and criteria ranked as high or unknown are summarized in Table 3-1 of the Phase I RFI Work Plan and shown in Figures 3-4a, 3-4b, 3-5a, 3-5b, and 3-5c of the Phase I RFI Work Plan. Those units or areas ranked low will be addressed later in the RFI

process. Upon completion of the first phase of the RFI, the prioritization process will be repeated to determine if the new data acquired will change the prioritization ranking for any unit or area.

1.4 Project Objectives and Intended Data Usages

For this project phase, it will be necessary to gather sufficient information to better assess the potential for release from the SWMUs and AOCs ranked "high" or "unknown" in the prioritization process (Section 1.3.3.3) and also to preliminarily assess the potential for adverse effects to human health and the environment as a result of releases from those units or areas. This could include evaluation of the potential impact of releases on human health and ecological receptors both within and beyond the facility property boundary. The additional information will allow investigation priorities to be re-evaluated.

The overall objectives of the data collection activity will be to accomplish the following:

- To determine whether a potential fire or explosion hazard exists in a SWMU ranked "unknown (low)" for this hazard;
- To provide information needed to better assess the potential release to air in SWMUs and AOCs ranked "unknown" for this potential and to better assess the potential magnitude of the effect on human health and the environment;
- To determine whether a release has occurred to surface soil in SWMUs and AOCs ranked "high" or "unknown" for potential adverse effects by direct contact and to assess preliminarily the potential magnitude of the associated effect to human health
- To determine whether releases to subsurface soil and, potentially, the groundwater flow system have occurred in SWMUs and AOCs ranked "high" or "unknown" for potential release to groundwater and whether the potential exists for continued constituent loading to the shallow groundwater flow system;
- To determine whether a release has occurred to surface soil or groundwater pools that could adversely affect surface water; and
- To strengthen the Conceptual Model for the East Chicago Facility.

The parameters listed in Table D1-1 are the collective proposed critical measurement parameters for this project.

1.4.1 Specific Objectives and Associated Tasks

The specific objectives and associated tasks of the data collection presented in Sections 3.3 and 3.4 of the Phase I RFI Work Plan are as follows:

- To determine if a potential fire or explosion hazard or a potential for adverse effects by release to air exists in the abandoned process sewers (SWMU 17B), a portable volatile organic vapor meter and an explosimeter will be used for field analysis. If concentrations of ignitable, explosive, or volatile organic compounds are found to be present in the airspace within the sewers at several manhole locations in the upper, middle and lower reaches of the sewers, sediment samples will be collected for volatile analysis at no more than two locations in SWMU 17B. The sample analyses to be performed are summarized in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. The fire and explosion hazard will be considered to exist if the sum of the concentrations of all ignitable compounds (those with a flash point < 140 °F) are greater than 1 percent by weight in the surface soil.

- Investigations will be performed at three SWMUs (4, 7, and 17B) and two AOCs (2E and 3J) that were ranked "unknown" for potential adverse effects by release of constituents to air. In order to provide information to better assess these potential releases and the potential magnitude of the effect on human health and the environment, sample(s) will be collected and analyzed for constituents that could be released to air. With the exception of the sewer analyses discussed in the previous paragraph, the determinations will be based on the analyte concentrations found in surface soil samples (collected from a depth of 0 to 2 feet below ground). The sample analyses to be performed at each SWMU and AOC are summarized in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. Relevant information relating to this potential for adverse effect and the investigative approach by SWMU or AOC are presented in Section 3.3.2 of the Phase I RFI Work Plan. The surface soil data obtained will be compared to the State of Illinois "Tiered Approach to Corrective Action Objectives (TACO) Table 1: Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties" to determine if the new data acquired will change the prioritization ranking of any unit or area.

- Surface soil (0-2 feet) samples will be collected at eight SWMUs (1C, 1K, 1J, 3, 4, 7, 20, and 21) and four AOCs (2E, 3J, 11, and 13) that were ranked either "high" or "unknown" for potential adverse effects on human health or the environment by direct contact. These samples will be used to determine whether a release has occurred to soil and to assess preliminarily the potential magnitude of the associated effect to human health and the environment. The sample analyses to be performed are summarized in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. Relevant information relating to this potential for adverse effect and the investigative approach by SWMU or AOC are presented in Section 3.3.3 of the Phase I RFI Work Plan. The surface soil data obtained will be compared to the US EPA Region 9 Preliminary Remediation Goals (PRGs) for industrial soil and to dermal contact-specific PRGs calculated from formulas provided by the US EPA Region 9 to determine if the new data acquired will change the prioritization ranking of any unit or area.

- Investigation activities will be performed at 28 SWMUs and 26 AOCs that were ranked "high" or "unknown" for potential release to subsurface soil and, potentially, to the groundwater flow system. Subsurface soil samples will be collected at these SWMUs and AOCs to: (1) determine whether releases to subsurface soil and, potentially, the groundwater flow system have occurred; and (2) determine whether the potential exists for continued constituent loading to the shallow groundwater flow system. These determinations will be based on analyte concentrations found in natural soils (whenever possible) or solid waste beneath the unit or area. Samples from the unsaturated zone will be collected for analysis. If no natural soil is encountered between the unit or area and the water table at the designated sampling site, the solid waste material above the water table at that site will be collected. The depth of the subsurface soil samples collected will be determined by the protocol described in Section 3.3.4 of the Phase I RFI Work Plan. The 28 SWMUs to be investigated for potential release to groundwater are SWMUs 1A, 1B, 1C, 1H, 1I, 1J, 1K, 2C, 2D, 3, 4, 5, 6A, 6E, 7, 8, 10A, 10B, 10C, 10D, 11, 12A, 12B, 14, 15, 17B, 20, and 21. The 26 AOCs to be investigated for potential release to groundwater are AOCs 1C, 1D, 1E, 1F, 1G, 2A, 2B, 2C, 2D, 2E, 2F, 3A, 3B, 3C, 3D, 3E, 3H, 3I, 3J, 5, 6, 8, 11, 12, 13, and 14. The sample analyses to be performed are summarized in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. Relevant information relating to this potential for adverse effect and the investigative approach by SWMU or AOC are presented in Section 3.3.4 of the Phase I RFI Work Plan. The subsurface soil data obtained will be compared to the industrial values in Table A of the "Risk-Integrated System of Closure, Technical Guidance Document, Interim

Draft" (IDEM, 1999) to determine if the new data acquired will change the prioritization ranking of any unit or area.

- Surface soil (0-2 feet) sampling will be conducted at five SWMUs (1C, 10A, 10C, 10D, and 20) that were ranked "unknown" for potential adverse effects on human health or the environment by release to surface water runoff. The sample analyses to be performed are summarized in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. Relevant information relating to this potential for adverse effect and the investigative approach by SWMU or AOC are presented in Section 3.3.5 of the Phase I RFI Work Plan. The surface soil data obtained will be compared to the US EPA Region 9 Preliminary Remediation Goals (PRGs) for industrial soil and to dermal contact-specific PRGs calculated from formulas provided by the US EPA Region 9 to determine if the new data acquired will change the prioritization ranking of any unit.

- Data will be collected to better characterize hydraulic conditions near the boundaries of three groundwater pools that were ranked "unknown" for potential adverse effects by groundwater discharge to surface water. In addition, some of the groundwater sampling and analysis to be performed (as discussed in the subsequent paragraphs) will also provide information needed to better characterize this potential. Once flow system boundaries are more clearly defined, additional investigation activities (e.g. surface water samples) will be evaluated for possible implementation (if needed) to determine whether adverse effects to surface water exist. Any surface water data obtained will be compared to Table 2, "ETs for Surface Water Quality," in the US EPA's *EcoUpdate*: Ecotox Thresholds for Surface Water Quality (January 1996) to determine if the new data acquired will change the prioritization ranking of the three pools.

- In order to strengthen the Conceptual Model, a map showing the extent of paved and vegetated areas will be constructed using air photography analysis prior to initiating sampling activities. This map will be used in evaluating potential pathways for release to air and direct contact and will be used to finalize sampling locations.

- Prior to initiating sampling activities, the existing monitoring wells and piezometers will be visually inspected to assess the integrity of the surface seal. DuPont will also sound each to determine depth-to-water and total depth of well. These observations and data will be compared to well construction logs contained in previous reports to determine the viability of the wells and piezometers to yield representative data. If wells/piezometers are deemed inadequate to provide representative data, DuPont will assess whether

replacement wells or piezometers are necessary to meet project objectives and, if so, install them during the Phase I field activities. The results of this review and proposal for replacement wells, if necessary, will be submitted to the US EPA in a technical memorandum.

- In order to strengthen the Conceptual Model, the groundwater-monitoring network will be enhanced to provide greater coverage for the monitoring of water levels and water quality at the facility. The seven new monitoring wells, 15 new piezometers, and 4 staff gauges to be installed are discussed in Section 3.4 of the Phase I RFI Work Plan.

- DuPont will collect three shelby tube samples from the top of the silty clay for laboratory analysis designed to determine hydraulic conductivity (Atterberg limits, particle-size distribution, and hydraulic conductivity) and to confirm the confirming properties of the unit. Information and data from previous reports and regional geological literature indicate that the silty clay unit underlying the surficial aquifer is continuous regionally and is about 100 feet in thickness at the site. The Phase III cone penetrometer test program consistently encountered the top of silty clay, which supports the literature with respect to the unit's continuity.

- Once soil samples are collected and wells are constructed, all borings, wells, piezometers, and staff gauges will be located by traditional survey methods or GPS methods. These locations will be documented on the base map.

- In order to strengthen the Conceptual Model, piezometric head measurements will be collected from all monitoring network locations (accessible monitoring wells, piezometers, and staff gauges), and groundwater flow maps will be developed. The data and maps will be used to develop a better understanding of the groundwater flow conditions near and beyond the eastern edge of the previously active manufacturing area and the hydraulic relationship between the surface water and shallow groundwater system at the facility. At least six sets of water level data will be collected over a 1-year period.

- In order to strengthen the Conceptual Model, groundwater samples will be collected from new and existing monitoring wells and analyzed for the analytes listed in Table 3-3 of the Phase I RFI Work Plan. Four rounds of sampling and analysis will be performed for a 1- to 2-year period. The results will be used to gain a better understanding of existing groundwater quality conditions at the facility and of variations in target constituent concentrations over time. The groundwater data obtained will be compared to the

industrial values in Table A of the "Risk-Integrated System of Closure, Technical Guidance Document, Interim Draft" to determine if the new data acquired will change the prioritization ranking of any unit or area. In addition, data for groundwater that may influence surface water will be compared to Table 2, "ETs for Surface Water Quality" in the US EPA's *EcoUpdate*: Ecotex Thresholds for Surface Water Quality (January 1996) to determine if the new data acquired will change the prioritization ranking of any unit or area.

- Statigraphic data collected during well, piezometer, and shelby tube installation will be used to upgrade geological cross sections (e.g., to better define the peat layer.) The additional information on site stratigraphy will also be used in refining the groundwater flow conceptual model for the site.

In order to accomplish the primary objectives, a confirmational level of analytical quality is needed. This level provides the highest level of data quality and may be used for purposes including, but not limited to, risk assessment, evaluation of remedial alternatives, and establishing cleanup levels. These analyses require full documentation of SW-846 analytical methods, sample preparation steps, data packages, and data validation procedures necessary to provide defensible data. Quality Control must be sufficient to define the precision and accuracy of these procedures at every step. The analytical data for all soil/sediment samples and for the first round of groundwater samples will undergo a full validation process. The analytical data for the last three rounds of groundwater samples will undergo a limited validation process. Based on the results of the limited validation, full validation may be performed if deemed necessary by the Phase I RFI DuPont CRG Project Coordinator. Full and limited validation procedures are described in Section 9.2.2 of this QAPP.

If, upon evaluation, the data generated during the Phase I RFI are not found to meet the project objectives previously described, DuPont will include any recommendations for additional data collection in the Phase I RFI report. If, after consultation with the US EPA Region 5 and the IDEM, it is decided that a subsequent RFI phase is required, it will be described in an amendment the RFI Work Plan (inclusive of this QAPP). Any subsequent RFI phase will begin subject to approval of these amendments by the US EPA Region 5.

1.4.2 Project Target Parameters and Intended Data Usages

The list of collective target parameters for the soil/sediment and groundwater matrices for this project is included in Table D1-1. The parameters for soil/sediment samples to be collected at

specific SWMUs and AOCs are included in Table 3-2 in the Phase I RFI Work Plan and Table E-1 of the FSP. The parameters for groundwater samples collected from specific monitoring wells are included in Table 3-3 in the Phase I RFI Work Plan. The rationale for the target parameters is presented in Section 2.3 of the Phase I RFI Work Plan. Intended data use is to repeat the prioritization process described previously in Section 1.3.3.3 of the QAPP. The first step of the prioritization process will be to compare the Phase I RFI data to the following pertinent screening tools.

- **Fire or Explosion Hazard**—Comparison of observed concentrations for RCRA ignitable wastes or volatile organic compounds with flash points <140°F to threshold concentrations greater than 1 percent;

- **Release to Air**—Comparison of surface soil/sediment samples to State of Illinois "Tiered Approach to Corrective Action Objectives (TACO) Table 1: Tier 1 Soil Remediation Objectives for Industrial/Commercial Properties";

- **Direct Contact**—Comparison of surface soil/sediment samples to the US EPA Region 9 PRGs for industrial soil and to dermal contact-specific PRGs calculated from formulas provided by the US EPA Region 9;

- **Release to Groundwater**—Comparison of subsurface soil and groundwater samples to the industrial values in Table A of the "Risk-Integrated System of Closure, Technical Guidance Document, Interim Draft" (IDEM, 1999); and

- **Release to Surface Water**—Comparison of surface soil to the US EPA Region 9 PRGs for industrial soil and to dermal contact-specific PRGs calculated from formulas provided by the US EPA Region 9 and comparison of shallow groundwater, and potentially surface water samples, to Table 2, "ETs for Surface Water Quality" in the US EPA's *EcoUpdate*: Ecotox Thresholds for Surface Water Quality (January 1996).

Some of the screening values are below method reporting limits. During the analytical design of the Phase I RFI and the preparation of this QAPP, the laboratory's practical quantitation limits (PQLs) and method detection limits (MDLs) were compared to the screening values, where available. The PQLs/MDLs and screening values for the soil/sediment and groundwater matrices are presented in Table D1-1. It is notable that many of the aqueous PQLs and, in some cases also the aqueous MDLs, are higher than the screening values for a number of the parameters listed in Table D1-1. The ability to meet the screening values without compromising the use of analytical

methodologies which represent the best available technology was also evaluated during the analytical design of the Phase I RFI. For the purposes of this evaluation, the best technology was defined as the analytical methodology that will achieve the lowest PQLs without compromising the high qualitative accuracy necessary for site characterization.

Possible alternate methods for the analysis for the target analytes that have MDLs greater than the screening values were considered. For the semivolatile organic compounds with MDLs greater than the aqueous RISC and/or Ecotox Thresholds (ETs) screening values, although GC or HPLC methodologies are available that may achieve lower PQLs/MDLs than by the GC/MS methodology; however, these methods do not achieve the high qualitative accuracy (e.g., mass spectroscopy) necessary for the characterization phase of a RFI. Therefore, SW-846 Method 8270C represents the best Agency-approved, commercially and practically available analytical methodology.

For organochlorinated pesticide compounds with MDLs greater than the aqueous ET screening values, the method proposed in this QAPP (SW-846 Method 8081A) achieves the lowest possible MDLs and, therefore, represents the best Agency-approved, commercially and practically available methodology.

For lead and selenium which have MDLs that are slightly greater than the aqueous ET screening values, atomic absorption methodology is available but this methodology achieves an MDL that is comparable to SW-846 6010B using Trace Inductively Coupled Plasma and, therefore, provides no benefit. SW-846 6010B using Trace Inductively Coupled Plasma represents the best Agency-approved, commercially and practically available methodology.

1.4.2.1 Field Parameters

The intended field parameters are Eh, pH, temperature, specific conductivity, and turbidity in groundwater samples, pH in soil samples, and organic vapor in sediment samples as measured by Photoionization Detector (PID) and an explosimeter.

1.4.2.2 Laboratory Parameters

The intended laboratory parameters for soil/sediment and groundwater samples are listed in Table D1-1. Groundwater samples will be collected and analyzed for both total and dissolved metals for the targeted metals listed in Table D1-1.

1.4.3 Data Quality Objectives

The intended data quality objectives (DQOs) for precision, accuracy, representativeness, comparability, and completeness for project data are discussed in Section 3 of this QAPP for all samples and are summarized in Attachment D1 to this QAPP. The intended DQO for sensitivity is to meet the PQLs for soil and sediment samples and to meet the MDL for groundwater samples. The PQLs and MDLs are summarized in Table D1-1. Error in quantitation increases as concentrations approach the MDLs; therefore, positive results between the MDL and PQL will be reported as quantitative estimates.

1.5 Sample Network Design and Rationale

The sample network design and rationale for sample locations (in respective media) is described in detail in Section 3 (Technical Approach) of the Phase I RFI Work Plan. Maps that show the sample locations are provided in Figures 3-6a, 3-6b, and 3-7 of the Phase I RFI Work Plan and Figure E-1 of the FSP.

1.5.1 Sample Network by Task and Matrix

Sample matrices, analytical parameters, and frequencies of sample collection can be found in Sections 3.3 (SWMU/AOC Investigations) and 3.4 (Supplemental Investigations) of the Phase I RFI Work Plan. The sample types, analytical parameters, and frequencies of investigative and QC sample collection are summarized in Tables D1-2 and D1-3.

1.5.2 Site Maps of Sampling Locations

Maps showing intended sediment, surface soil, subsurface soil, and groundwater sampling locations are included as Figures 3-6a, 3-6b, and 3-7 in the Phase I RFI Work Plan and Figure E-1 of the FSP. It is possible, however, that, depending on the nature of encountered field conditions, some of these locations will be changed. Potential modifications to sample locations will be communicated to the US EPA RCRA Project Coordinator in a timely fashion so as to not jeopardize the project schedule.

1.5.3 Rationale of Selected Sampling Locations

The rationale for the selection of sampling locations (and depths) were chosen is described in detail in Sections 3.3 and 3.4 of the Phase I RFI Work Plan.

1.5.4 Sample Network Summary Table

The sample network for this project is presented in tabular format in Table E-1 of the FSP and Tables D1-2 and D1-3 of this QAPP.

1.6 Project Schedule

1.6.1 Anticipated Date of Project Mobilization

Mobilization of project resources will be initiated within 30 days of receiving Phase I RFI Work Plan and QAPP approval from the US EPA Region 5. It is anticipated that field activities will require 3 months to complete. A draft schedule is included as Figure C-1 of the Project Management Plan, which has been included as Appendix C of the Phase I RFI Work Plan.

1.6.2 Task Bar Chart and Associated Timeframes

The dates of projected milestones are indicated in Section 4 of the Project Management Plan, which has been included as Appendix C of the Phase I RFI Work Plan.

TABLE D1-1: PROJECT TARGET PARAMETERS

CAS# (1)	Analyte Name	Analysis Method (2)	SOLID SAMPLE						AQUEOUS SAMPLE OR BLANK				
			TACO (3)	PRG (4)	RISC (5)	PQL (6)	MDL (7)	UNITS	RISC (5)	ET (8)	PQL (6)	MDL (7)	UNITS
Volatiles													
67-64-1	Acetone	SW-846 8260B	100,000,000	8,800,000	41,000	20	7	ug/kg	10,000	NR (9)	20	6	ug/L
71-43-2	Benzene	SW-846 8260B	1,500	1,400	670	5	1	ug/kg	99	46	5	1	ug/L
74-97-5	Bromochloromethane	SW-846 8260B	NR (9)	NR (9)	NR (9)	5	1	ug/kg	NR (9)	NR (9)	5	1	ug/L
75-27-4	Bromodichloromethane	SW-846 8260B	3,000,000	1,400	630	5	2	ug/kg	100	NR (9)	5	1	ug/L
75-25-2	Bromoform	SW-846 8260B	100,000	240,000	2,700	5	1	ug/kg	360	NR (9)	5	1	ug/L
74-83-9	Bromomethane (Methyl bromide)	SW-846 8260B	15,000	23,000	700	5	3	ug/kg	140	NR (9)	5	3	ug/L
591-78-6	2-Butanone (Methyl ethyl ketone)	SW-846 8260B	NR (9)	27,000,000	260,000	10	7	ug/kg	61,000	NR (9)	10	3	ug/L
75-15-0	Carbon Disulfide	SW-846 8260B	720,000	24,000	82,000	5	3	ug/kg	10,000	NR (9)	5	3	ug/L
56-23-5	Carbon Tetrachloride	SW-846 8260B	640	500	290	5	1	ug/kg	22	NR (9)	5	1	ug/L
108-90-7	Chlorobenzene	SW-846 8260B	210,000	220,000	27,000	5	1	ug/kg	2,000	130	5	1	ug/L
75-00-3	Chloroethane	SW-846 8260B	NR (9)	1,600,000	NR (9)	5	3	ug/kg	NR (9)	NR (9)	5	3	ug/L
67-66-3	Chloroform	SW-846 8260B	540	530	2,700	5	1	ug/kg	470	NR (9)	5	1	ug/L
74-87-3	Chloromethane (Methyl chloride)	SW-846 8260B	NR (9)	2,600	NR (9)	5	2	ug/kg	NR (9)	NR (9)	5	3	ug/L
124-48-1	Dibromochloromethane	SW-846 8260B	1,300,000	23,000.00	NR (9)	5	1	ug/kg	NR (9)	NR (9)	5	2	ug/L
75-34-3	1,1-Dichloroethane	SW-846 8260B	1,700,000	1,700,000	58,000	5	1	ug/kg	10,000	47	5	2	ug/L
107-06-2	1,2-Dichloroethane	SW-846 8260B	700	550	150	5	2	ug/kg	31	NR (9)	5	2	ug/L
156-59-2	*cis*-1,2-Dichloroethene	SW-846 8260B	1,200,000	100,000	5,800	5	2	ug/kg	1,000	NR (9)	5	2	ug/L
156-60-5	*trans*-1,2-Dichloroethene	SW-846 8260B	3,100,000	270,000	14,000	5	2	ug/kg	2,000	NR (9)	5	2	ug/L
75-35-4	1,1-Dichloroethene	SW-846 8260B	1,500,000	80	58	5	2	ug/kg	7	NR (9)	5	1	ug/L
10061-01-5	*cis*-1,3-Dichloropropene	SW-846 8260B	230 (10)	550 (10)	110 (10)	5	1	ug/kg	16 (10)	NR (9)	5	1	ug/L
78-87-5	1,2-Dichloropropane	SW-846 8260B	23,000	680	250	5	3	ug/kg	42	NR (9)	5	1	ug/L
10061-02-6	*trans*-1,3-Dichloropropene	SW-846 8260B	230 (10)	550 (10)	110 (10)	5	1	ug/kg	16 (10)	NR (9)	5	1	ug/L
100-41-4	Ethylbenzene	SW-846 8260B	400,000	230,000	200,000	5	1	ug/kg	1,000	290	5	2	ug/L
591-78-6	2-Hexanone	SW-846 8260B	NR (9)	NR (9)	NR (9)	10	3	ug/kg	NR (9)	NR (9)	10	7	ug/L
75-09-2	Methylene Chloride	SW-846 8260B	24,000	18,000	1,800	5	2	ug/kg	380	NR (9)	5	2	ug/L
108-10-1	4-Methyl-2-pentanone	SW-846 8260B	NR (9)	2,800,000	NR (9)	10	3	ug/kg	NR (9)	NR (9)	10	5	ug/L
100-42-5	Styrene	SW-846 8260B	1,500,000	680,000	720,000	5	1	ug/kg	20,000	NR (9)	5	1	ug/L
79-43-5	1,1,2,2-Tetrachloroethane	SW-846 8260B	NR (9)	1,100	110	5	1	ug/kg	14	420	5	2	ug/L
127-18-4	Tetrachloroethene	SW-846 8260B	20,000	17,000	640	5	1	ug/kg	55	120	5	1	ug/L
108-88-3	Toluene	SW-846 8260B	650,000	880,000	240,000	5	1	ug/kg	20,000	130	5	2	ug/L
71-55-6	1,1,1-Trichloroethane	SW-846 8260B	1,200,000	3,000,000	89,000	5	1	ug/kg	9,200	62	5	1	ug/L
79-00-5	1,1,2-Trichloroethane	SW-846 8260B	1,800,000	1,500	300	5	2	ug/kg	50	NR (9)	5	2	ug/L
79-01-6	Trichloroethene	SW-846 8260B	8,900	7,000	3,000	5	1	ug/kg	260	350	5	1	ug/L
75-01-4	Vinyl Chloride	SW-846 8260B	60	35	13	5	2	ug/kg	2	NR (9)	5	2	ug/L
1330-20-7	Xylenes (total)	SW-846 8260B	410,000	320,000	410,000	5	1	ug/kg	180,000	1.8 (11)	5	1	ug/L
75-69-4	Freon-11 (Trichlorofluoromethane)	SW-846 8260B	NR (9)	NR (9)	NR (9)	5	2	ug/kg	NR (9)	NR (9)	5	2	ug/L
75-71-8	Freon-12 (Dichlorodifluoromethane)	SW-846 8260B	NR (9)	NR (9)	NR (9)	5	2	ug/kg	NR (9)	NR (9)	5	2	ug/L
110-54-3	Hexane	SW-846 8260B	NR (9)	NR (9)	NR (9)	5	1	ug/kg	NR (9)	NR (9)	5	2	ug/L
Semivolatiles													
83-32-9	Acenaphthene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	4,200	23	10	1	ug/L
208-96-8	Acenaphthylene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
120-12-7	Anthracene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	43	NR (9)	10	1	ug/L
56-55-3	Benzo[a]anthracene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	3.9	NR (9)	10	1	ug/L
205-99-2	Benzo[b]fluoranthene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	1.5	NR (9)	10	1	ug/L
207-08-9	Benzo[k]fluoranthene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	0.8	NR (9)	10	1	ug/L

TABLE D1-1: PROJECT TARGET PARAMETERS

CAS# (1)	Analyte Name	Analysis Method (2)	SOLID SAMPLE						AQUEOUS SAMPLE OR BLANK				
			TACO (3)	PRG (4)	RISC (5)	PQL (6)	MDL (7)	UNITS	RISC (5)	ET (8)	PQL (6)	MDL (7)	UNITS
Semivolatiles (Cont.)													
191-24-2	Benzo[ghi]perylene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
50-32-8	Benzo[a]pyrene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	0.39	0.014	10	1	ug/L
111-91-1	Bis(2-chloroethoxy)methane	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
111-44-4	Bis(2-chloroethyl)ether	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	2.6	NR (9)	10	1	ug/L
117-81-7	Bis(2-ethylhexyl)phthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	200	32	10	2	ug/L
101-55-3	4-Bromophenyl-phenyl ether	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	1.5	10	2	ug/L
85-68-7	Butylbenzylphthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	2,700	19	10	2	ug/L
86-74-8	Carbazole	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	140	NR (9)	10	1	ug/L
106-47-8	4-Chloroaniline	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	410	NR (9)	10	1	ug/L
91-58-7	2-Chloronaphthalene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
7005-72-3	4-Chlorophenyl-phenyl ether	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
218-01-9	Chrysene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	1.6	NR (9)	10	1	ug/L
84-74-2	Di-*n*-butylphthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	10,000	33	10	2	ug/L
53-70-3	Dibenz[a,h]anthracene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	0.39	NR (9)	10	1	ug/L
132-64-9	Dibenzofuran	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	20	10	1	ug/L
95-50-1	1,2-Dichlorobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	9,200	14	10	1	ug/L
541-73-1	1,3-Dichlorobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	3,100	71	10	1	ug/L
106-46-7	1,4-Dichlorobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	120	15	10	1	ug/L
91-94-1	3,3'-Dichlorobenzidine	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	6.4	NR (9)	10	2	ug/L
84-66-2	Diethylphthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	82,000	220	10	2	ug/L
131-11-3	Dimethylphthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	2	ug/L
121-14-2	2,4-Dinitrotoluene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	4.2 (13)	NR (9)	10	1	ug/L
606-20-2	2,6-Dinitrotoluene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	4.2 (13)	NR (9)	10	2	ug/L
117-84-0	Di-*n*-octylphthalate	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	20	NR (9)	10	2	ug/L
206-44-0	Fluoranthene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	210	8.1	10	1	ug/L
86-73-7	Fluorene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	2,000	4	10	1	ug/L
118-74-1	Hexachlorobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	1.8	NR (9)	10	2	ug/L
77-47-4	Hexachlorocyclopentadiene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	720	NR (9)	25	5	ug/L
67-72-1	Hexachloroethane	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	100	12	10	1	ug/L
87-68-3	Hexachlorobutadiene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	20	NR (9)	10	2	ug/L
193-39-5	Indeno[1,2,3-cd]pyrene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	0.022	NR (9)	10	1	ug/L
78-59-1	Isophorone	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	3,000	NR (9)	10	1	ug/L
91-57-6	2-Methylnaphthalene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
91-20-3	Naphthalene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	2,000	24	10	1	ug/L
88-74-4	2-Nitroaniline	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	2	ug/L
99-09-2	3-Nitroaniline	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	2	ug/L
100-01-6	4-Nitroaniline	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	2	ug/L
98-95-3	Nitrobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	51	NR (9)	10	1	ug/L
86-30-6	*N*-Nitrosodiphenylamine (14)	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	590	NR (9)	10	1	ug/L
621-64-7	*N*-Nitroso-di-*n*-propylamine	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	0.41	NR (9)	10	1	ug/L
108-60-1	2,2'-Oxybis(1-chloropropane)	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	41	NR (9)	10	1	ug/L
85-01-8	Phenanthrene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	10	1	ug/L
108-95-2	Phenol	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	61,000	NR (9)	10	1	ug/L
129-00-0	Pyrene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	140	NR (9)	10	1	ug/L
120-82-1	1,2,4-Trichlorobenzene	SW-846 8270C	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	1,000	110	10	1	ug/L

TABLE D1-1: PROJECT TARGET PARAMETERS

CAS# (1)	Analyte Name	Analysis Method (2)	SOLID SAMPLE						AQUEOUS SAMPLE OR BLANK				
			TACO (3)	PRG (4)	RISC (5)	PQL (6)	MDL (7)	UNITS	RISC (5)	ET (8)	PQL (6)	MDL (7)	UNITS
Organochlorine Pesticides													
72-54-8	4,4'-DDD	SW-846 8081A	NR (9)	7,900	121,000	0.67	0.13	ug/kg	12	NR (9)	0.02	0.004	ug/L
72-55-9	4,4'-DDE	SW-846 8081A	NR (9)	5,600	96,000	0.67	0.13	ug/kg	8.4	NR (9)	0.02	0.004	ug/L
50-29-3	4,4'-DDT	SW-846 8081A	1,500,000	5,600	96,000	0.67	0.13	ug/kg	8.4	0.013	0.02	0.004	ug/L
72-43-5	Methoxychlor	SW-846 8081A	NR (9)	3,400,000	180,000	3.3	0.67	ug/kg	45	0.019	0.1	0.02	ug/L
PCBs													
12674-11-2	Aroclor-1016	SW-846 8082	NR (9)	65,000	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
11104-28-2	Aroclor-1221	SW-846 8082	NR (9)	19,000 (15)	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
11141-16-5	Aroclor-1232	SW-846 8082	NR (9)	19,000 (15)	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
53469-21-9	Aroclor-1242	SW-846 8082	NR (9)	19,000 (15)	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
12672-29-6	Aroclor-1248	SW-846 8082	NR (9)	19,000 (15)	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
11097-69-1	Aroclor-1254	SW-846 8082	NR (9)	19,000	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
11096-82-5	Aroclor-1260	SW-846 8082	NR (9)	19,000 (15)	5,300 (16)	17	3.3	ug/kg	1.4 (16)	0.19 (16)	0.5	0.1	ug/L
Organochlorine Herbicide													
94-75-7	2,4-D	SW-846 8151A	NR (9)	6,800,000	NR (9)	17	3.3	ug/kg	NR (9)	NR (9)	0.5	0.1	ug/L
Metals													
7429-90-5	Aluminum	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	200	52	ug/L
7440-36-0	Antimony (Trace)	SW-846 6010B	NR (9)	680	37	1.0	0.42	mg/kg	41	NR (9)	10	5.3	ug/L
7440-38-2	Arsenic (Trace)	SW-846 6010B	1,200	2.6 (20)	20	1.0	0.39	mg/kg	50	8.1	10	7.0	ug/L
7440-39-3	Barium (Trace)	SW-846 6010B	910,000	100,000	5,900	0.4	0.018	mg/kg	7,200	3.9	10	0.2	ug/L
7440-42-8	Boron (Trace)	SW-846 6010B	1,000,000	61,000	NR (9)	4.0	1.60	mg/kg	NR (9)	NR (9)	40	20.0	ug/L
7440-43-9	Cadmium (Trace)	SW-846 6010B	2,800	850	77	0.10	0.051	mg/kg	51	1.0	1.5	0.63	ug/L
7440-70-2	Calcium	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	200	38	ug/L
7440-47-3	Chromium (Trace)	SW-846 6010B	420	450	196	0.50	0.18	mg/kg	510	10 (17)	3.0	1.7	ug/L
7440-50-8	Copper (Trace)	SW-846 6010B	NR (9)	63,000	1,700	0.50	0.18	mg/kg	3,800	11	4.0	1.7	ug/L
7439-89-6	Iron	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	1,000	100	16	ug/L
7439-92-1	Lead (Trace)	SW-846 6010B	NR (9)	1,000	227	1.0	0.40	mg/kg	42	2.5	10.0	6.5	ug/L
7439-95-4	Magnesium	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	100	40	ug/L
7439-96-5	Manganese	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	31	80	10	1.6	ug/L
7439-97-6	Mercury	SW-846 7470A	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	2,000	1.3	0.20	0.040	ug/L
7440-02-0	Nickel (Trace)	SW-846 6010B	21,000	34,000	2,700	0.60	0.21	mg/kg	510	160	5.0	3.0	ug/L
7782-44-2	Selenium (Trace)	SW-846 6010B	NR (9)	8,500	53	1.0	0.410	mg/kg	510	5.0	10.0	5.9	ug/L
7440-23-5	Sodium	SW-846 6010B	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	600	93	ug/L
7440-62-2	Vanadium (Trace)	SW-846 6010B	NR (9)	12,000	NR (9)	0.20	0.072	mg/kg	NR (9)	19	2.0	1.04	ug/L
7440-66-6	Zinc (Trace)	SW-846 6010B	NR (9)	100,000	10,000	3.0	0.65	mg/kg	31,000	100	20	3.6	ug/L
Wet Chemistry													
57-12-5	Cyanide, Total	SW-846 9012A	NR (9)	35 (18)	NR (9)	0.5	0.18	mg/kg	NR (9)	0.0052	0.005	0.002	mg/L
18540-29-9	Hexavalent Chromium	SW-846 3060A/7196A	420	64	NR (9)	1	0.26	mg/kg	NA (12)	NR (9)	NA (12)	NA (12)	NA (12)
16984-48-8	Soluble Fluoride	SW-846 9056	NR (9)	41,000	NR (9)	1	0.8	mg/kg	NR (9)	NR (9)	0.10	0.08	mg/L
16887-00-6	Soluble Chloride	SW-846 9056	NR (9)	170,000	NR (9)	4	3	mg/kg	NR (9)	NR (9)	0.4	0.3	mg/L
C-005	Total Nitrite/Nitrate Nitrogen	EPA 353.2	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	0.10	0.03	mg/L
14808-79-8	Soluble Sulfate	SW-846 9056	NR (9)	NR (9)	NR (9)	10	3	mg/kg	NR (9)	NR (9)	1.0	0.30	mg/L
7723-14-0	Total Phosphorus	EPA 365.1	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NA (12)	NR (9)	NR (9)	0.05	0.03	mg/L

ENVIRONMENTAL STANDARDS

Setting the Standards for Innovative Environmental Solutions

July 28, 1998

Mr. Allan Wojtas
Project Coordinator
US EPA Region 5
Enforcement and Compliance Assurance Branch, DRE-9J
77 W. Jackson Blvd.
Chicago, IL 60604-3590

RE: DuPont East Chicago, Indiana Sediment Characterization Study, US EPA ID Number IND 005 174 354

Dear Mr. Wojtas:

Environmental Standards, Inc. (Environmental Standards) has completed the Revision 1 of the "Quality Assurance Project Plan for the Sediment Characterization Study at E.I. duPont de Nemours and Company's Chemical Manufacturing Plant in East Chicago, Indiana, U.S. EPA ID Number IND 005 174 354" (QAPP). This revision incorporates the changes summarized in DuPont's correspondence issued in June 1998 that addressed U.S. EPA Region 5 comments to Revision 0 of the QAPP. We are submitting three (3) copies of the text of Revision 1 of the QAPP on the behalf of DuPont. Please replace the text of Revision 0 previously submitted in the QAPP binders with the enclosed text for Revision 1. In addition, we are submitting the following replacement/additions to the attachments to the QAPP:

- A revised Attachment F1 is being submitted. Please replace the Attachment F1 previously submitted in the QAPP binders with the enclosed revised Attachment F1.

- Two Lancaster Laboratories standard operating procedures (SOPs) for Inductively Coupled Plasma (ICP) analysis are being submitted for addition to Attachment F7. A revised SOP listing for Attachment F7 is also being submitted to reflect the additional SOPs. Please replace the Attachment F7 SOP listing previously submitted in the QAPP binders with the enclosed SOP listing. Please add the enclosed ICP SOPs to Attachment F7 in the order indicated on this SOP listing.

ENVIRONMENTAL STANDARDS, INC.
VALLEY FORGE, PA

1140 Valley Forge Road, P.O. Box 911, Valley Forge, PA 19482-0911 ▪ 610-935-5577 ▪ Internet OffNPL@EnvStd.com
1111 Kennedy Place, Suite 2, Davis, CA 95616 ▪ 916-758-1903 ▪ Internet ENVSTDWEST@AOL.com
Copper Bend Centre, 956 South 59th Street, Belleville, IL 62223 ▪ 618-257-3800 ▪ Internet MIDWEST@EnvStd.com
World Wide Web HTTP://www.EnvStd.com/

- One Lancaster Laboratories SOP for balance operation is being submitted for addition to Attachment F10. A revised SOP listing for Attachment F10 is also being submitted to reflect the additional SOP. Please replace the Attachment F10 SOP listing previously submitted in the QAPP binders with the enclosed SOP listing. Please add the enclosed balance SOP to Attachment F10 in the order indicated on this SOP listing.

Furthermore, we are submitting SOPs for field measurements for addition to Attachment B1 of the Field Sampling Plan (FSP), which was previously submitted as Appendix B to the "Sediment Characterization Study Work Plan for the DuPont East Chicago Facility." Finally, we are submitting the original Title/Signature Page which currently has been signed by the applicable personnel from DuPont and DuPont's consultants. If the QAPP revisions are acceptable, please sign this Title/Signature Page, copy it for your records, and return the original to Mr. Frank Smith at DuPont.

If you should have any questions or comments, please contact Mr. Frank Smith of DuPont at 302-992-6769.

Sincerely,

David R. Blye

David R. Blye
Quality Assurance Specialist/Principal
dblye@EnvStd.com

Meg A. Clark

Meg A. Clark
Senior Quality Assurance Chemist II
megclark@EnvStd.com

MAC:hb

cc. Mr. Frank Smith - DuPont Corporate Remediation Group
Mr. Chris Myers - IDEM
Mr. Kurt Whitman - TetraTech, Inc.

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QUALITY ASSURANCE PROJECT PLAN

FOR THE RCRA SEDIMENT CHARACTERIZATION STUDY AT

E.I. DU PONT DE NEMOURS AND COMPANY'S

CHEMICAL MANUFACTURING PLANT IN EAST CHICAGO, INDIANA

U.S. EPA ID NUMBER IND 005 174 254

REVISION 1

JULY 31, 1998

Prepared by: Enviromental Standards, Inc.

Prepared for: DuPont Corporate Remediation Group

Mr. Frank Smith - DuPont CRG Project Coordinator	7/27/98 Date
Dr. Lucinda Jacobs - Exponent Project Manager	7/23/98 Date
Mr. Alan Egler - WCD Project Manager	07/27/98 Date
Dr. Harry Gearhart - DuPont CRG QA Manager	7/22/98 Date
Mr. David Blye - Environmental Standards QA Manager	7-20-98 Date
Ms. Kathleen Loewen - Lancaster Laboratories QA Officer	7/21/98 Date
Mr. Eric Yeggy - NET QA Officer	7/24/98 Date
Mr. Allan Wojtas - US EPA RCRA Project Coordinator	8/5/98 Date
Mr. Brian Freeman - US EPA ~~Regional~~ Quality Assurance ~~Manager~~ ECAB Coordinator	8/5/98 Date

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Ms. Kathleen Loewen - Lancaster Laboratories QA Officer	7/21/98 Date
Mr. Eric Yeggy - NET QA Officer	7/24/98 Date
Mr. Allan Wojtas - US EPA RCRA Project Coordinator	Date
Mr. Brian Freeman - US EPA Regional Quality Assurance Manager	Date

QUALITY ASSURANCE PROJECT PLAN

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Mr. Allan Wojtas - US EPA RCRA Project Coordinator	Date
Mr. Brian Freeman - US EPA Regional Quality Assurance Manager	Date

TABLE OF CONTENTS

Page

Page

Page

Page

Page

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

Attachment No.	Description
F1	Data Quality Objectives
F2	Lancaster Laboratories Volatiles Preparation and Analysis SOPs
F3	Lancaster Laboratories Semivolatiles Preparation, Clean-up, and Analysis SOPs
F4	Lancaster Laboratories Organochlorine Pesticide/PCB and PCB only Preparation, Clean-up, and Analysis SOPs
F5	Lancaster Laboratories Organochlorine Herbicide Preparation and Analysis SOPs
F6	Lancaster Laboratories General Gas Chromatography SOPs
F7	Lancaster Laboratories Metals Preparation and Inductively Coupled Plasma (ICP trace) Analysis SOPs
F8	Lancaster Laboratories Mercury Preparation and Analysis SOPs
F9	Lancaster Laboratories Metals Preparation and Graphite Furnace Atomic Absorption (GFAA) Analysis SOPs
F10	Lancaster Laboratories Wet Chemistry Preparation and Analysis SOPs
F11	NET Wet Chemistry Preparation and Analysis SOPs
F12	Lancaster Laboratories Internal Chain-of-Custody Documentation SOP and NET's Procedure for Chain of Custody SOP
F13	Lancaster Laboratories Analytical Method Validation and Method Detection Limit Determination SOPs
F14	Data Validation SOPs
F15	Lancaster Laboratories Example Reporting Forms
F16	Field Audit Checklist
F17	Lancaster Laboratories Audit Checklist
F18	NET Audit Checklist

LIST OF PERSONS WHO HAVE RECEIVED THIS QAPP

1. Mr. Hilton Frey - DuPont CRG
2. Mr. Frank Smith - DuPont CRG
3. Mr. Alan Egler - WCD
4. Dr. Lucinda Jacobs - Exponent
5. Dr. Harry Gearhart - DuPont CRG
6. Ms. Kim Johnson - DuPont CRG
7. Ms. Kathleen Loewen - Lancaster Laboratories
8. Mr. Eric Yeggy - NET
9. Mr. David Blye - Environmental Standards
10. Ms. Meg Clark - Environmental Standards
11. Mr. Tim Dull - WCIA
12. Mr. Allan Wojtas - US EPA Region 5 RCRA Permitting Branch
13. Mr. Brian Freeman - US EPA Region 5 RCRA Permitting Branch

SECTION 1

PROJECT DESCRIPTION

1.0 Project Description

The E.I. du Pont de Nemours and Company (DuPont) has entered into an agreement with the US Environmental Protection Agency (US EPA) pursuant to Resource Conservation and Recovery Act (RCRA) Corrective Action Order (Order) IND 005 174 354 (US EPA 1997), dated June 25, 1997, to conduct an investigation of the sediments within a portion of the East Branch (the study area) of the Grand Calumet River (GCR) adjacent to DuPont's East Chicago Facility. This document presents the quality assurance project plan (QAPP) for the Sediment Characterization Study (SCS). The SCS will be completed in a phased approach to allow for the collection of data in a logical and scientific manner.

1.1 Introduction

This QAPP is an integral part of the approved "Sediment Characterization Study Work Plan for the DuPont East Chicago Facility" (SCS Work Plan). This QAPP presents the organization, objectives, planned activities, and specific quality assurance (QA)/quality control (QC) procedures associated with the Phase I SCS for the DuPont East Chicago Facility. Specific protocols for sampling, sample handling and storage, Chain-of-Custody, and laboratory and field analyses will be described. All QA/QC procedures will be structured in accordance with applicable US EPA requirements, regulations, guidance, and technical standards. This QAPP was prepared in accordance with a guidance manual entitled "Region 5 Model RCRA Quality Assurance Project Plan," May, 1993.

This QAPP has been prepared on behalf of DuPont by Environmental Standards, Inc. (Environmental Standards). DuPont has previously submitted the "Current Conditions Report for the DuPont East Chicago Facility," prepared by CH2M Hill, under a separate cover on October 28, 1997. The Current Conditions Report (CCR) presented DuPont's understanding of site conditions based on a consolidation of existing information available for review, and the report should be considered entirely incorporated into the QAPP through specific reference. In addition, a Project Management Plan, a Field Sampling Plan (FSP), a Data Management Plan, a Health and Safety Plan, and a Community Relations Plan have been appended to the SCS Work Plan, prepared by PTI Environmental Services (PTI). This QAPP has also been prepared to be entirely incorporated into the SCS Work Plan as Appendix F.

It is DuPont's belief that the sediment investigation outlined in the SCS Work Plan should be guided by the principles of the Great Lakes Water Quality Agreement of 1978. In order to evaluate environmental improvements that may be achieved in a specific area of concern, an understanding of what has impaired or is still impairing the beneficial uses of that area of concern is required. As such, the SCS Work Plan has incorporated into the design of the sediment investigation specific tasks that will identify where data gaps exist and potential sources of information (i.e., scientific literature, sediment sampling, etc.) that will be used to develop a better understanding of the GCR at local and regional levels. This knowledge will allow the regional stakeholders to begin to evaluate the potential benefits of various remedial alternatives in meeting the goal of environmental improvement for the Indiana Harbor Canal, GCR, and Nearshore Lake Michigan Area of Concern (AOC). Recognizing that unknown or poorly understood variables are inherent in investigations of complex systems, the SCS will be completed in a phased approach. This approach allows data to be collected in a logical and scientific manner.

1.1.1 Overall Project Objectives

Specific objectives for the Phase I SCS are:

- To meet the intent of the Order by investigating the presence of constituents that may be related to the DuPont East Chicago Facility in sediments of the East Branch of the GCR and adjacent wetlands and eventually compare this data to the "Ecological Data Quality Levels RCRA Appendix IX Hazardous Constituents, US Environmental Protection Agency, Region 5";

- To develop a conceptual understanding of physical and chemical processes that affect constituent distributions in the study area;

- To collect information on the beneficial uses that are alleged to have been impaired in the study area, as well as information that will contribute to an understanding of the causes of those impaired uses;

- To collect information on past and present constituent loading to the East Branch of the GCR that will contribute to an understanding of how those constituents have contributed to the impaired uses.

1.1.2 Project Scope-of-Work

In order to meet the project objectives, the following activities will be completed.

- Existing data review;
- Environmental media sampling; and
- Data evaluation.

Available information/data on the physical and chemical conditions within the GCR will be assembled and evaluated to clarify the conceptual model and will determine if the field investigation proposed in the SCS Work Plan adequately meets the project objectives. Currently, this program consists of:

- Surface sediment (0 to 10 cm) sampling;
- Near-surface sediment (10-20 cm and 20-30 cm) sampling;
- Deep sediment core sampling;
- Wetlands surface sediment sampling;
- Surface water sampling; and
- Surface water hydrology and sediment dynamics assessment.

Sediment samples will be analyzed collectively for the parameters listed in Table F1-1. Surface water samples will be analyzed collectively for the parameters listed in Table F1-2.

At the conclusion of the Phase I investigation, DuPont will evaluate whether the SCS data are sufficient to develop a comprehensive understanding of processes presently affecting contaminant transport and fate in the study area and to evaluate the current status of impaired beneficial uses. This evaluation will be a determining factor in decisions regarding the necessity for additional field and laboratory studies of sediment

and/or surface water in a subsequent SCS phase. After considering the SCS and existing data, DuPont will prepare the Phase I SCS report, which will include any recommendations for additional data collection, if any, in a subsequent phase of the SCS. If, after consultation with the US EPA Region 5 and the Indiana Department of Environmental Management (IDEM), it is decided that an additional phase of the SCS is required, it will be described in an amendment to the SCS Work Plan and QAPP. The rationale and scope of any Phase II investigation will be discussed with and approved by the US EPA prior to implementation.

1.1.3 QAPP Preparation Guidelines

As explained above, this QAPP has been prepared in accordance with the "Region 5 Model RCRA Quality Assurance Project Plan", dated May, 1993. Furthermore, a meeting was held with the US EPA in which the Region's protocol for preparation of QAPPs was reviewed. Additional guidance was received at the meeting on how to prepare this QAPP. This meeting was a formal "pre-QAPP" meeting. At the meeting, representatives from the US EPA's Environmental Sciences Division were present and available for consultation with representatives of DuPont, Environmental Standards, Inc., and Lancaster Laboratories. Following this meeting, Revision 0 of the QAPP was submitted in April 1998 to the US EPA Region 5 for review. In May 1998, DuPont received comments on Revision 0 of the QAPP from US EPA Region 5. DuPont submitted responses on the comments to the US EPA Region 5, which were verbally approved by the US EPA Region 5. Revision 1 of the QAPP incorporates the changes discussed in the responses to the US EPA comments.

1.2 Site/Facility Description

A brief description of the facility, its geological setting, and associated features is presented in the section below.

1.2.1 Location

The DuPont East Chicago Facility is a chemical manufacturing plant located at 5215 Kennedy Avenue, East Chicago, in Lake County, Indiana. The DuPont East Chicago Facility property is located along the East Branch of the GCR between Cline Avenue and Kennedy Avenue. Maps of the facility property are provided as Figures 2-1 and 2-2 of the SCS Work Plan. Development occurred primarily on the western part of the property. The southern part of the developed area was used for manufacturing

purposes (the "primary manufacturing area") while the northern part and the eastern edge of the developed area were used for waste management purposes. The eastern part of the property (the "natural area") has not been developed.

The study area for the East Chicago SCS is the portion of the East Branch of the GCR from Cline Avenue downstream to the confluence, including the Indiana Harbor Canal and the adjacent wetlands (the wetlands upstream of the historical DuPont outfalls and the wetlands adjacent to the Harbison-Walker and U.S.S. Lead facilities).

1.2.2 Facility/Size and Borders

The approximately 440-acre East Chicago Facility property is bounded on the west by Kennedy Avenue, on the north and northeast by the Indiana Harbor Belt Railroad, on the east by the Chicago South Shore and South Bend Railroad and a property owned by the City of East Chicago, and on the south by the East Branch of the GCR. The East Chicago Facility is one of hundreds of industrial facilities located within an industrial region defined by Lake Michigan to the north, Interstate 94 to the south, the Indiana/Illinois border to the west, and the eastern edge of the City of Gary to the east.

Sections entitled "Regional and Site Development Overview" and "Surrounding Land Use" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-1 through 2-2). These sections of the CCR provide additional detail regarding the setting of the East Chicago Facility.

1.2.3 Natural and Manmade Features

Today, the East Chicago facility comprises four main areas: (1) the active manufacturing area; (2) the previously active manufacturing area; (3) waste management areas outside the manufacturing areas; and (4) a natural area.

Site development included regarding and construction of manufacturing buildings, utilities, and roadways. A significant part of the land surface within the manufacturing areas was compacted and paved during site development. Though all the aboveground facilities in this previously active manufacturing area have been removed, foundations, building rubble, and pavement can be seen on the land surface in many of the former operating areas. Limited vegetative cover or habitat has existed historically within the manufacturing and waste management areas of the facility. General refuse, wastewater treatment filter cake, process filter cake, ash, construction debris, and demolition debris

were disposed of on land north of manufacturing operations. Only one landfill area remains active today. Vegetation is reestablishing itself over most of the inactive manufacturing and waste management areas. The original region consisted of a series of beach ridges separated by swales with many marshy areas. Within the natural area, a remnant ridge and swale (also referred to as dune and swale) community is present.

With specific regard to the study area, the GCR currently flows from east to west into Lake Michigan through the Indiana Harbor Canal. Although termed a river, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges.

A chapter entitled "Facility Setting And Physical Characteristics" has been presented in the CCR (Chapter 2). This chapter of the CCR provides additional detail regarding the physical characteristics of the East Chicago Facility.

1.2.4 Topography

Sections entitled "Regional Topography and Drainage" and "Site Topography and Drainage" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-2 through 2-4). These sections of the CCR provide information regarding the general topography of the East Chicago Facility property.

1.2.5 Local Hydrology and Hydrogeology

Sections entitled "Meterology and Surface Water Hydrology," "Hydrogeology," and "Regional Water Supply" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-3 through 2-4 and pg. 2-6 through 2-9). These sections of the CCR provide information regarding the local hydrology and hydrogeology of the East Chicago Facility property and surrounding region.

1.3 Site History

1.3.1 General History

The facility was established in 1892 to manufacture inorganic chemicals by the Grasselli Corporation. DuPont operated the facility for Grasselli from 1927-1936. In 1936, the facility was formally deeded to DuPont, who has operated the facility since

that time. The facility grew between 1893 and 1945, covering nearly 160 acres by 1930.

Manufacturing operations were limited to the western portion of the property (the eastern portion of the property was never developed). Over its 105-year lifetime, the East Chicago facility produced more than 100 products which include inorganic acids and chemicals (e.g., sulfuric, nitric, hydrochloric, phosphoric and fluorosulfonic acids); various chloride, ammonia, and zinc products; inorganic agricultural chemicals; trichlorofluoromethane (TCFM) or Freon® products; and several organic herbicides and insecticides (e.g., hexazinone). Operations have significantly declined since the end of World War II. The facility now manufactures a colloidal silica product (Ludox®) and sodium silicate solution.

A chapter entitled "Facility Operations" has been presented in the CCR (Chapter 3). This chapter of the CCR provides additional detail regarding the historic operations, describes the waste management practices, and identifies the solid waste management units (SWMUs) and Areas of Concern (AOCs) of the East Chicago Facility.

With specific regard to the study area, the drainage network within the GCR basin has been severely disrupted since the late nineteenth century to provide for navigation, wastewater discharge, and site drainage. The GCR originally flowed from west to east; discharging into Lake Michigan near the present location of Marquette Park. Early in the twentieth century, the Indiana Harbor Canal was dredged, bisecting the GCR into the East and West Branches and creating a new outlet into Lake Michigan. The former mouth of the river became permanently closed by sand dunes, and the flow was reversed in the East Branch, with discharge to Lake Michigan through the Indiana Harbor Canal.

As previously noted, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges. The total volume of wastewater discharged into the East Branch is constantly changing as a result of alterations in industrial and municipal wastewater treatment. The wastewater discharge has been characterized as representing in excess of 90 percent of the present flow in the East Branch. Over 20 permitted industrial outfalls and one municipal outfall are currently located upstream of the East Chicago Facility. Additional detail regarding the East Branch of the GCR is provided in Sections 2.2 (Physical Setting) and 3.2 (Conceptual Model) of the SCS Work Plan.

1.3.2 Past Data Collection Activities

DuPont has conducted several environmental investigations of various media (soil, groundwater, river bank water) at the East Chicago Facility since 1983. These environmental investigations are described briefly in Table 4-1 of the CCR. The environmental media and constituent groups analyzed and the data quality level generated (primarily level IV) during these investigations are listed in Table 4-2 of the CCR. The constituents detected in the various environmental media are summarized in Table 4-3 of the CCR. The primary constituents detected in environmental media at the facility were inorganic compounds, with the most frequent detections being the major ions (i.e., those ions which are prevalent in the environment and are primary components of rock, soil, and water [e.g., calcium, magnesium, sodium]), water quality parameters (e.g., nitrates), and metals. Organic compounds were rarely detected in environmental media at the facility. The frequency of detection and concentrations of these constituents in various environmental media is summarized in Tables 4-5 and 4-6, respectively, of the CCR. Although many of the detected constituents occur naturally in the environment, many were also components of products or waste streams at the facility, as summarized in Table 4-4 of the CCR.

A chapter entitled "Current Understanding of Environmental Quality Conditions" is presented in the CCR (Chapter 4). This chapter of the CCR provides an overview of the investigative activities conducted at the East Chicago Facility, summarizes available data quality data by medium and constituent groups, discusses data limitations, and describes the results of characterization work completed to date.

In addition, numerous environmental investigations of the GCR have been conducted by state and federal agencies, as well as other interested parties. Elevated concentrations of metals, oil and grease, and organic compounds (i.e., phenols, organochlorine pesticides, and volatile and semivolatile aromatic compounds) have been found in the sediments as discussed in "Grand Calumet River - Indiana Harbor Canal Sediment Cleanup and Restoration Alternatives Project," (Draft Report, US Army Corps of Engineers, Chicago District, Great Lakes and Ohio River Division, Chicago, IL, 1997) and in "Toxicity of Sediments and Sediment Pore Waters from the Grand Calumet River - Indiana Harbor, Indiana Area of Concern," (Hoke, R.A., J.P Giesy, M. Zabik, and M. Unger, 1993, Ecotoxicology and Environmental Safety 26:86-112). Fecal coliform bacteria, nutrients, metals, organic compounds, and conventional parameters have been routinely found in the surface water and are discussed in "Streamflow and

Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois, October 1984," (US Geological Survey, Water Resources Division, Indianapolis, IN, in cooperation with the Indiana State Board of Health, 1987, Water-Resources Investigation Report 86-4208). Information on sediments, surface water and sources, surface water hydrology and sediment transport, wetlands, and biological resources is summarized in Section 2.3 (Results of Initial Evaluation of Available Information) of the SCS Work Plan. Efforts will continue to acquire and evaluate additional information from other sources throughout the SCS process, and this data will be presented in the Phase 1 SCS report.

In its Stage 1 Remedial Action Plan (RAP) for the Indiana Harbor Canal, GCR, and Nearshore Lake Michigan AOC, the IDEM (IDEM 1991) identified 14 beneficial uses that were either confirmed to be impaired or considered likely to be impaired. These beneficial uses are listed in Table 3-1 of the SCS Work Plan. Sediment contamination is considered to be a major cause of use impairments in most of the Great Lakes areas of concern. Enough information is known about the effects of environmental contaminants on biological organisms to link some of the alleged impaired uses with substances introduced to the environment. Table 3-2 of the SCS Work Plan summarizes known associations between alleged impairments, substances in the environment, and the environmental media of primary or secondary importance in the use impairment. The substances in the environment that are associated with various use impairments include metals, mercury, PCBs, chlorinated pesticides, dioxins and dioxin-like compounds, polycyclic aromatic hydrocarbons (PAHs), oil and grease, nutrients, grain size, other sediment conventional parameters, fecal coliform bacteria, and dissolved oxygen. Additional detail on the impaired beneficial uses is provided in Section 3.1 of the SCS Work Plan.

1.3.3 Current Status

The preliminary conceptual model of the GCR (Section 3.2 of the SCS Work Plan) provides the framework for understanding the conditions and processes affecting source loading, chemical distributions, and sediment dynamics. Ultimately, any selected restoration alternative should maximize the improvement in impaired uses, minimize the potential for recontamination of surface water and sediments, and minimize adverse effects on existing wetlands. The conditions and processes of greatest interest and related information needs are described in Tables 4-1, 4-2, and 4-3 of the SCS Work Plan.

1.4 Project Objectives

In its Stage 1 RAP, the IDEM (IDEM 1991) identified 14 beneficial uses that were either confirmed to be impaired or considered likely to be impaired for the AOC, as previously stated. Additional details on these 14 beneficial uses are provided in Section 3.1 of the SCS Work Plan. In order to understand the conditions and processes affecting source loading, constituent distributions, and sediment dynamics in the GCR in the vicinity of the East Chicago Facility, a preliminary conceptual model was developed. Information to be collected throughout the SCS will be used to refine and further develop that conceptual model. Additional details on the preliminary conceptual model, which was developed to serve as the framework for understanding the key conditions and processes that affect the Constituents of Interest (COIs) in the larger GCR - Indiana Harbor Canal system, are provided in Section 3.2 of the SCS Work Plan. The way in which the processes are incorporated into the technical approach to the SCS is described in Section 4 of the SCS Work Plan.

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during SCS activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality.

1.4.1 Specific Objectives and Associated Tasks

The collection of information, either through field sampling and laboratory analyses or through the synthesis of data from sources, will be used to understand how contaminants in the GCR contribute to the alleged impaired uses and identify the potential source(s) of those contaminants.

The specific objectives of the data collection presented in Section 5.3 of the SCS Work Plan are as follows:

- Surface sediment (0 to 10 cm, considered the biologically active zone) sampling and analysis will be conducted to determine the chemical and physical properties of sediment to which human and ecological receptors may be exposed, investigate the distribution of constituents of interest (COIs) in sediments, identify any ongoing sources of COIs at the East Chicago Facility, and determine if ongoing sources upstream of DuPont are providing COIs to surface sediments in the study area. Select surface sediment samples will be analyzed for benzene/ethylbenzene/toluene/

total xylenes (BTEX), PAHs and phenols, organochlorine pesticides and PCBs, metals, acid volatile sulfides (AVS), simultaneously extracted metals (SEM), oil and grease, soluble fluoride, phenolics, pH, total organic carbon (TOC), total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, total kjeldahl nitrogen (TKN), and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the surface sediment sampling and analysis is provided in Section 5.3.2.1 of the SCS Work Plan.

- Near-surface sediment (10-20 cm and 20-30 cm) sampling and analysis will be conducted to determine the chemical properties of sediments that could be exposed if sediment were eroded or scoured and the degree of natural recovery that has occurred as industrial and municipal sources on the East Branch have been controlled in recent years. Select near-surface sediment samples will be analyzed for BTEX, PAHs and phenols, organochlorine pesticides and PCBs, metals, AVS, SEM, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, TKN, and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the near-surface sediment sampling and analysis is provided in Section 5.3.2.2 of the SCS Work Plan.

- Deep sediment core sampling and analysis will be conducted to determine the chemical and physical properties of historically deposited sediments and associated industrial and municipal releases and to assess the potential for chemicals associated with buried sediment to migrate to surface sediments or surface water. Select deep sediment core samples will be analyzed for PAHs and phenols, organochlorine pesticides and PCBs, metals, AVS, SEM, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, TKN, and/or total phosphorus, as defined in Table F1-1. Additional detail on the rationale for the deep sediment core sampling and analysis is provided in Section 5.3.2.3 of the SCS Work Plan.

- Wetlands surface sediment sampling and analysis will be conducted to determine if constituents potentially associated with DuPont discharges could have impacted the wetlands. Select wetlands sediment samples will be analyzed for BTEX, PAHs and phenols, organochlorine pesticides and PCBs, the herbicide compound 2,4-D, metals, AVS, SEM, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen,

TKN, and/or total phosphorus, as defined in Table F1-1. Additional detail on the rationale for the wetlands sediment sampling and analysis is provided in Section 5.3.2.4 of the SCS Work Plan.

- Surface water sampling and analysis will be conducted to determine the concentrations of selected COIs in the vicinity of the East Chicago Facility, to determine the trophic state of the East Branch and its potential effect on plant and animal life, to provide an indication of the loading of COIs to the study area from upstream sources, and to determine the effect of rainfall events on overall water quality. Select surface water samples will be analyzed for total and dissolved metals, COD, BOD, fecal coliform bacteria, oil and grease, phenolics, ammonia nitrogen, nitrate/nitrite nitrogen, TKN, orthophosphate, total phosphorus, TSS, and/or hardness as defined in Table F1-2. Furthermore, field parameters (pH, conductivity, temperature, and dissolved oxygen) will be measured periodically throughout sampling. Additional detail on the rationale for the surface water sampling and analysis is provided in Section 5.3.3 of the SCS Work Plan.

- Source loading evaluation will be performed to determine the magnitude of ongoing source loading, its potential effect on COI concentrations in surface water and sediment of the East Branch, and the need to further control sources prior to evaluation of potential remedial alternatives. The net loading to the river in the vicinity of the East Chicago Facility will be evaluated from the surface water sampling data previously mentioned. Additional detail on the rationale for the source loading evaluation is provided in Section 5.3.4 of the SCS Work Plan.

- Surface water hydrology and sediment dynamics will be assessed to determine the potential for erosion and downstream transport of surface sediments, exposure of underlying sediments, and the relative contribution of point source particulate loading and surface sediment resuspension to sediment loading into the Indiana Harbor Canal by the GCR. This evaluation will be conducted in close coordination with ongoing efforts of the US Army Corps of Engineers. The grain size data collected as part of the sediment sampling task will be used in the bed erosion and deposition predictions. Observations concerning the general cohesiveness of the sediments will also be made in the field. In addition, flow measurements will be made in conjunction with the surface water sampling task and continuous measurements of water surface elevations will be made at each end of the study

area. Additional detail on the rationale for the surface water hydrology and sediment dynamics assessment is provided in Section 5.3.5 of the SCS Work Plan.

In order to accomplish these goals, a confirmational level of analytical quality is needed. This provides the highest level of data quality and may be used for purposes including, but not limited to, risk assessment, evaluation of remedial alternatives, and establishing cleanup levels. These analyses require full documentation of SW-846 analytical methods, sample preparation steps, data packages, and data validation procedures necessary to provide defensible data. Quality Control must be sufficient to define the precision and accuracy of these procedures at every step. Analytical data from critical analysis fractions (BTEX, PAHs, phenols, organochlorine pesticides, PCBs, organochlorine herbicide 2,4-D, metals, total cyanide, AVS, and SEM) will undergo a full validation process. A percentage (20%) of analytical data from non-critical analysis fractions (all wet chemistry except total cyanide and AVS) will also undergo the full validation process. All data that are not validated in full will undergo a limited validation process. Full and limited validation procedures are described in Section 9.2.2 of this QAPP.

Additional aliquots of the surface and near-surface sediment samples not designated for the organic analyses PAHs, phenols, pesticides, and PCBs as well as deep sediment cores and wetland sediment samples will be collected for possible future analysis for PAHs, phenols, pesticides, and PCBs as defined in Table F1-1. These samples will be archived in frozen condition at the laboratory until such time that it is decided to analyze them. The results of these possible sample analyses will be used for additional informational purposes, and these samples will not be subject to many of the requirements presented in this QAPP.

If, upon evaluation, the data generated during the Phase I SCS is not found to meet the project objectives previously described, DuPont will include any recommendations for additional data collection in the Phase I SCS report. If, after consultation with the US EPA Region 5 and the IDEM, it is decided that a subsequent SCS phase is required, it will be described in an amendment the SCS Work Plan (inclusive of this QAPP). Any subsequent SCS phase will begin subject to approval of these amendments by the US EPA Region 5.

1.4.2 Project Target Parameters and Intended Data Usages

The list of collective target parameters for the sediment and surface water matrices for this project is included in Tables F1-1 and F1-2, respectively. The rationale for the target parameters is presented in Table 5-1 of the SCS Work Plan. Intended data use is to screen for levels of target parameters that may pose a current or potential threat to human health or the environment. The data shall be compared to the "Ecological Data Quality Levels RCRA Appendix IX Hazardous Constituents US Environmental Protection Agency, Region 5," however, as acknowledged in this document, some of these ecological data quality levels (EDQLs) are below method reporting limits (MRLs).

During the analytical design of the Phase I SCS and the preparation of this QAPP, the laboratory's practical quantitation limits (PQLs) and method detection limits (MDLs) were compared to the EDQLs, where available. The PQLs/MDLs and EDQLs for the sediment and surface water matrices are presented in Tables F1-1 and F1-2, respectively. It is notable that many of the PQLs and, in some cases also the MDLs, are higher than the EDQLs for a number of the parameters listed in Tables F1-1 and F1-2. The ability to meet the EDQLs without compromising the use of analytical methodologies which represent the best available technology was also evaluated during the analytical design of the Phase I SCS. For the purposes of this evaluation, the best technology was defined as the analytical methodology which will achieve the lowest PQLs without compromising the high qualitative accuracy necessary for site characterization. For this project, the choice of the best technology also took into consideration the site-specific features and complex matrices (i.e., high oil and grease) of the sediments and surface water of the GCR.

As previously stated, although termed a river, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges. Previous environmental investigations have found elevated concentrations of numerous parameters, including extremely high levels of oil and grease. The extremely high levels of oil and grease will mostly hinder the performance of chromatography methods, although other analyses may also be impacted by interference from these constituents. Therefore, the techniques with the highest qualitative accuracy have been chosen for the Phase I SCS (i.e., GC/MS methodologies have been chosen over GC and HPLC methodologies wherever possible). In addition, sample clean-ups will be performed at the discretion of the laboratory analysts whenever it is believed that the cleanups may enhance the sample analysis.

1.4.2.1 Field Parameters

The intended field parameters are pH, temperature, specific conductivity, dissolved oxygen, stream flow, and elevation in the surface water.

1.4.2.2 Laboratory Parameters

The intended laboratory parameters for sediment and surface water samples are listed in Tables F1-1 and F1-2, respectively. Surface water samples will be collected and analyzed for both total and dissolved metals for the targeted metals listed in Table F1-2.

1.4.3 Data Quality Objectives

The intended data quality objectives (DQOs) for precision, accuracy, representativeness, comparability, and completeness for project data are discussed in Section 3 of this QAPP for all samples except the archived samples and are summarized in Attachment F1 to this QAPP. The intended DQO for sensitivity is to meet the PQLs for parameters where the PQL is less than or equal to the EDQL and to meet MDLs for all other parameters. The sensitivity DQO for constituents that have no EDQL will be to meet the MDL. The PQLs and MDLs are summarized in Tables F1-1 and F1-2. Error in quantitation increases as concentrations approach the MDLs. Therefore, positive results between the MDL and PQL will be reported as quantitative estimates.

1.5 Sample Network Design and Rationale

The sample network design and rationale for sample locations (in respective media) is fully described in detail in Section 5.3 (Task 2 Sediment Characterization Area Investigation) of the SCS Work Plan. Maps which show the sample locations are provided in Figures B-1 and B-2 of the FSP, which has been included as Appendix B to the SCS Work Plan.

1.5.1 Sample Network by Task and Matrix

Sample matrices, analytical parameters, and frequencies of sample collection can be found in Sections 2.2 (Sediment Sampling), 2.3 (Surface Water Sampling), and 2.5 (Wetlands Evaluation) of the FSP, which has been included as Appendix B to the SCS

Work Plan. The sample types, analytical parameters, and frequencies of investigative and QC sample collection are summarized in Tables F1-3 and F1-4.

1.5.2 Site Maps of Sampling Locations

Maps showing intended soil, sediment and surface water sampling locations are included as Figures in the FSP, which has been included as Appendix B to the SCS Work Plan. It is possible, however, that, depending on the nature of encountered field conditions, some of these locations will be changed. Potential modifications to sample locations will be communicated to the US EPA RCRA Project Coordinator in a timely fashion so as to not jeopardize the project schedule.

1.5.3 Rationale of Selected Sampling Locations

The rationale for why the selected sampling locations (and depths) were chosen is fully described in detail in Section 5.3 (Task 2 Sediment Characterization Area Investigation) of the SCS Work Plan.

1.5.4 Sample Network Summary Table

The sample network for this project is presented in tabular format in Tables F1-3 and F1-4.

1.6 Project Schedule

1.6.1 Anticipated Date of Project Mobilization

Mobilization of project resources will be initiated within 30 days of receiving SCS Work Plan and QAPP approval from the US EPA Region 5. It is anticipated that field activities will require 3 months to complete. A draft schedule is included as Figure 5-3 of the SCS Work Plan.

1.6.2 Task Bar Chart and Associated Timeframes

The dates of projected milestones are indicated in Figure 5-3 of the SCS Work Plan.

TABLE F1-1: PROJECT TARGET PARAMETERS IN SEDIMENT

CAS# (1)	Analyte Name	Analysis Method (2)	SEDIMENT				AQUEOUS BLANK		
			EDQL (3)	PQL (4)	MDL (5)	UNITS	PQL	MDL	UNITS
BTEX									
71-43-2	Benzene	SW-846 8260B	142	5	1	ug/Kg	5	1	ug/L
100-41-4	Ethylbenzene	SW-846 8260B	0.1	5	1	ug/Kg	5	2	ug/L
108-88-3	Toluene	SW-846 8260B	52,500	5	1	ug/Kg	5	2	ug/L
1330-20-7	Xylenes (total)	SW-846 8260B	1,880	5	1	ug/Kg	5	1	ug/L
Polycyclic Aromatic Hydrocarbons (PAHs) and Phenols									
83-32-9	Acenaphthene	SW-846 8270C	6.71	330	33	ug/Kg	10	1	ug/L
208-96-8	Acenaphthylene	SW-846 8270C	5.87	330	33	ug/Kg	10	2	ug/L
120-12-7	Anthracene	SW-846 8270C	46.9	330	33	ug/Kg	10	1	ug/L
56-55-3	Benzo[a]anthracene	SW-846 8270C	31.7	330	33	ug/Kg	10	1	ug/L
205-99-2	Benzo[b]fluoranthene	SW-846 8270C	1,040	330	33	ug/Kg	10	2	ug/L
207-08-9	Benzo[k]fluoranthene	SW-846 8270C	240	330	33	ug/Kg	10	1	ug/L
191-24-2	Benzo[ghi]perylene	SW-846 8270C	170	330	33	ug/Kg	10	1	ug/L
50-32-8	Benzo[a]pyrene	SW-846 8270C	31.9	330	33	ug/Kg	10	1	ug/L
59-50-7	4-Chloro-3-methylphenol	SW-846 8270C	11	330	33	ug/Kg	10	1	ug/L
95-57-8	2-Chlorophenol	SW-846 8270C	12	330	33	ug/Kg	10	1	ug/L
218-01-9	Chrysene	SW-846 8270C	57.1	330	33	ug/Kg	10	1	ug/L
132-64-9	Dibenzofuran	SW-846 8270C	1,520	330	33	ug/Kg	10	1	ug/L
53-70-3	Dibenz[a,h]anthracene	SW-846 8270C	6.22	330	33	ug/Kg	10	2	ug/L
120-83-2	2,4-Dichlorophenol	SW-846 8270C	134	330	33	ug/Kg	10	1	ug/L
105-67-9	2,4-Dimethylphenol	SW-846 8270C	305	330	33	ug/Kg	10	1	ug/L
534-52-1	4,6-Dinitro-2-methylphenol	SW-846 8270C	10	830	170	ug/Kg	25	5	ug/L
51-28-5	2,4-Dinitrophenol	SW-846 8270C	1	830	170	ug/Kg	25	5	ug/L
206-44-0	Fluoranthene	SW-846 8270C	111.3	330	33	ug/Kg	10	1	ug/L
86-73-7	Fluorene	SW-846 8270C	21.2	330	33	ug/Kg	10	1	ug/L
193-39-5	Indeno[1,2,3-cd]pyrene	SW-846 8270C	200	330	33	ug/Kg	10	1	ug/L
78-59-1	Isophorone	SW-846 8270C	422	330	33	ug/Kg	10	1	ug/L
91-57-6	2-Methylnaphthalene	SW-846 8270C	20.2	330	33	ug/Kg	10	1	ug/L
95-48-7	2-Methylphenol	SW-846 8270C	0.826	330	33	ug/Kg	10	1	ug/L
65794969	3 or 4-Methylphenol	SW-846 8270C	0.808	330	67	ug/Kg	10	3	ug/L
91-20-3	Naphthalene	SW-846 8270C	34.6	330	33	ug/Kg	10	1	ug/L
88-75-5	2-Nitrophenol	SW-846 8270C	8	330	33	ug/Kg	10	1	ug/L
100-02-7	4-Nitrophenol	SW-846 8270C	8	830	170	ug/Kg	25	5	ug/L
87-86-5	Pentachlorophenol	SW-846 8270C	30,200	830	170	ug/Kg	25	5	ug/L
85-01-8	Phenanthrene	SW-846 8270C	41.9	330	33	ug/Kg	10	2	ug/L
108-95-2	Phenol	SW-846 8270C	27	330	67	ug/Kg	10	1	ug/L
129-00-0	Pyrene	SW-846 8270C	53	330	33	ug/Kg	10	1	ug/L
95-95-4	2,4,5-Trichlorophenol	SW-846 8270C	5,390	330	33	ug/Kg	10	1	ug/L
88-06-2	2,4,6-Trichlorophenol	SW-846 8270C	85	330	33	ug/Kg	10	2	ug/L
Organochlorine Pesticides									
309-00-2	Aldrin	SW-846 8081A	2	0.33	0.08	ug/Kg	0.01	0.002	ug/L
319-84-6	*alpha*-BHC	SW-846 8081A	6	0.33	0.15	ug/Kg	0.01	0.003	ug/L
319-85-7	*beta*-BHC	SW-846 8081A	5	0.33	0.32	ug/Kg	0.01	0.003	ug/L
319-86-8	*delta*-BHC	SW-846 8081A	71,500	0.33	0.17	ug/Kg	0.01	0.003	ug/L
58-89-9	*gamma*-BHC/Lindane	SW-846 8081A	0.94	0.33	0.09	ug/Kg	0.01	0.002	ug/L
72-54-8	4,4'-DDD	SW-846 8081A	5,030	0.67	0.44	ug/Kg	0.01	0.004	ug/L
72-55-9	4,4'-DDE	SW-846 8081A	1.42	0.67	0.51	ug/Kg	0.01	0.005	ug/L
50-29-3	4,4'-DDT	SW-846 8081A	1.19	0.67	0.51	ug/Kg	0.01	0.008	ug/L
60-57-1	Dieldrin	SW-846 8081A	2	0.67	0.13	ug/Kg	0.02	0.004	ug/L
959-98-8	Endosulfan I	SW-846 8081A	0.175	0.33	0.23	ug/Kg	0.01	0.002	ug/L
33213-65-9	Endosulfan II	SW-846 8081A	0.104	0.67	0.39	ug/Kg	0.02	0.01	ug/L
1031-07-8	Endosulfan sulfate	SW-846 8081A	35	0.67	0.27	ug/Kg	0.02	0.012	ug/L
72-20-8	Endrin	SW-846 8081A	2.67	0.67	0.23	ug/Kg	0.02	0.008	ug/L
7421-93-4	Endrin aldehyde	SW-846 8081A	3,200	0.67	0.16	ug/Kg	0.02	0.012	ug/L
76-44-8	Heptachlor	SW-846 8081A	0.6	0.33	0.23	ug/Kg	0.01	0.003	ug/L
1024-57-3	Heptachlor epoxide	SW-846 8081A	0.6	0.33	0.06	ug/Kg	0.01	0.002	ug/L
72-43-5	Methoxychlor	SW-846 8081A	4	3.3	2.34	ug/Kg	0.1	0.04	ug/L
8001-35-2	Toxaphene	SW-846 8081A	0.109	33	7	ug/Kg	1.0	0.2	ug/L
5103-71-9	*alpha*-Chlordane	SW-846 8081A	4.5 (6)	0.33	0.067	ug/Kg	0.01	0.002	ug/L
5103-74-2	*gamma*-Chlordane	SW-846 8081A	4.5 (6)	0.33	0.067	ug/Kg	0.01	0.002	ug/L

TABLE F1-1: PROJECT TARGET PARAMETERS IN SEDIMENT

CAS# (1)	Analyte Name	Analysis Method (2)	SEDIMENT EDQL (3)	SEDIMENT PQL (4)	SEDIMENT MDL (5)	SEDIMENT UNITS	AQUEOUS BLANK PQL	AQUEOUS BLANK MDL	AQUEOUS BLANK UNITS
PCBs									
12674-11-2	Aroclor-1016	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
11104-28-2	Aroclor-1221	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.3	ug/L
11141-16-5	Aroclor-1232	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
53469-21-9	Aroclor-1242	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
12672-29-6	Aroclor-1248	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.1	ug/L
11097-69-1	Aroclor-1254	SW-846 8082	34.1 (7)	17	3.6	ug/Kg	0.5	0.1	ug/L
11096-82-5	Aroclor-1260	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.1	ug/L
Organochlorine Herbicides									
94-75-7	2,4-D	SW-846 8151A	6	17	5.5	ug/Kg	0.5	0.1	ug/L
Metals									
7440-36-0	Antimony	SW-846 6010B	NA	1.0	0.38	mg/Kg	10	4.1	ug/L
7440-38-2	Arsenic	SW-846 6010B	5.9	1.0	0.38	mg/Kg	10	5.0	ug/L
7440-38-2	Arsenic	SW-846 7060A	5.9	2.0	0.086	mg/Kg	10	2.0	ug/L
7440-43-9	Cadmium	SW-846 6010B	0.596	0.10	0.039	mg/Kg	1.5	0.42	ug/L
7440-47-3	Chromium	SW-846 6010B	26	0.50	0.18	mg/Kg	3.0	1.3	ug/L
7440-50-8	Copper	SW-846 6010B	16	0.50	0.13	mg/Kg	4.0	1.4	ug/L
7439-92-1	Lead	SW-846 6010B	31.0	1.0	0.40	mg/Kg	5.0	3.4	ug/L
7439-92-1	Lead	SW-846 7421	31.0	1.0	0.15	mg/Kg	3.0	1.1	ug/L
7439-95-4	Magnesium	SW-846 6010B	NA	5.0	1.6	mg/Kg	50	16	ug/L
7439-97-6	Mercury	SW-846 7470A/7471A	0.174	0.10	0.0028	mg/Kg	0.20	0.020	ug/L
7439-98-7	Molybdenum	SW-846 6010B	NA	5	1.1	mg/Kg	0.05	0.012	ug/L
7440-02-0	Nickel	SW-846 6010B	16	0.60	0.11	mg/Kg	5.0	1.6	ug/L
7440-22-4	Silver	SW-846 6010B	0.5	0.2	0.077	mg/Kg	2.0	0.81	ug/L
7440-62-2	Vanadium	SW-846 6010B	NA	0.20	0.062	mg/Kg	2.0	0.99	ug/L
7440-66-6	Zinc	SW-846 6010B	120	3.0	0.48	mg/Kg	20	0.49	ug/L
Simultaneously Extracted Metals									
7440-38-2	Arsenic	SW-846 6010B/7000A	NA	0.04	0.007	umole/g	0.04	0.007	umole/g
7440-43-9	Cadmium	SW-846 6010B/7000A	NA	0.005	0.004	umole/g	0.005	0.004	umole/g
7440-47-3	Chromium	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7440-50-8	Copper	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7439-92-1	Lead	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7439-97-6	Mercury	SW846-7470A	NA	0.0002	0.000004	umole/g	0.0002	0.000004	umole/g
7440-02-0	Nickel	SW846-6010B	NA	0.02	0.004	umole/g	0.02	0.004	umole/g
7440-66-6	Zinc	SW846-6010B	NA	0.04	0.005	umole/g	0.04	0.005	umole/g
Wet Chemistry									
(8)	Grain Size	ASTM D422-63	NA	NA	NA	%	NA	NA	NA
7723-14-0	Total Phosphorus	EPA 365.1	NA	12.5	10	mg/Kg	0.05	0.04	mg/L
EVS-0162	Acid Volatile Sulfides	EPA/821-R-91-100	NA	1	0.2	umole/g	1	0.2	umole/L
7664-41-7	Ammonia Nitrogen	EPA 350.1	NA	20	5.2	mg/Kg	0.10	0.03	mg/L
57125	Cyanide, Total	SW846 9012A	0.1	0.125	0.1	mg/Kg	0.005	0.004	mg/L
16984-48-8	Soluble Fluoride	SW-846 9056	NA	1	0.8	mg/Kg	0.1	0.08	mg/L
C-007	Oil & Grease	SW-846 9071A	NA	2000	600	mg/Kg	2.5	8	mg/L
C-006	pH	SW-846 9045C	NA	NA	NA	SU	NA	NA	SU
C-008	Total Solids	EPA 160.3	NA	0.50	0.10	%	NA	NA	NA
C-020	Phenolics	SW-846 9066	NA	0.1	0.25	mg/Kg	0.01	0.004	mg/L
C-021	Total Kjeldahl Nitrogen	EPA 351.2	NA	500	175	mg/Kg	2.0	0.70	mg/L
C-012	Total Organic Carbon	EPA 415.1	NA	50	10	mg/Kg	1.0	0.3	mg/L
18496-25-8	Total Sulfide	SW-846 9030B/9034	NA	20	5.46	mg/Kg	2	0.56	mg/L
14808-79-8	Soluble Sulfate	SW-846 9056	NA	10	3	mg/Kg	1.0	0.30	mg/L

NOTES:

(1) Fictitious CAS number created to represent the coeluting isomers 3-methylphenol and 4-methylphenol. Also, fictitious CAS number assigned to wet chemistry parameters since an actual CAS # does not exist.

(2) SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," Third Edition (with Updates).
EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020.

(3) EDQL= Ecological Data Quality Level

(4) PQL = Practical Quantitation Limit. Sample-specific quantitation limits are highly matrix-dependent. The PQLs listed may not always be achievable. Sample-specific PQLs will be adjusted for % solids and volumes and dilutions which vary from standard procedures.

(5) MDL = Method Detection Limit. Sample-specific detection limits are highly matrix-dependent. The MDLs listed may not always be achievable. Sample-specific MDLs will be adjusted for % solids and volumes and dilutions which vary from standard procedures.

(6) EDQL presented is actually the EDQL for technical chlordane

(7) EDQL presented is actually the EDQL for total polychorinated biphenyls

(8) Grain size will be reported by the percent in a certain mm sized sieve. Therefore, a CAS # is not applicable to grain size.

TABLE F1-2: PROJECT TARGET PARAMETERS IN SURFACE WATER

CAS# (1)	Analyte Name	Analysis Method (2)	SURFACE WATER EDQL (3)	PQL (4)	MDL (5)	UNITS
Select Metals	(Total and Dissolved)					
7440-36-0	Antimony	SW-846 6010B	31.00	10	4.1	ug/L
7440-38-2	Arsenic	SW-846 6010B	53.00	10	5.0	ug/L
7440-38-2	Arsenic	SW-846 7060A	53.00	10	2.0	ug/L
7440-43-9	Cadmium	SW-846 6010B	0.66	1.5	0.42	ug/L
7440-47-3	Chromium	SW-846 6010B	42.00	3.0	1.3	ug/L
7440-50-8	Copper	SW-846 6010B	5.00	4.0	1.4	ug/L
7439-92-1	Lead	SW-846 6010B	1.30	5.0	3.4	ug/L
7439-92-1	Lead	SW-846 7421	1.30	3.0	1.1	ug/L
7439-97-6	Mercury	SW-846 7470A	0.0130	0.20	0.020	ug/L
7440-02-0	Nickel	SW-846 6010B	29.00	5.0	1.6	ug/L
7440-66-6	Zinc	SW-846 6010B	58.90	20	4.9	ug/L
Wet Chemistry						
7664-41-7	Ammonia Nitrogen	EPA 350.1	NA	0.10	0.03	mg/L
C-002	Biochemical Oxygen Demand	EPA 405.1	NA	2.0	0.9	mg/L
C-004	Chemical Oxygen Demand	EPA 410.4	NA	50	8.95	mg/L
U-004	Fecal Coliform	SM 9221C	NA	NA	NA	colonies/100mL
471341	Hardness	EPA 130.2	NA	3.0	0.68	mg/L
C-005	Nitrate/Nitrite Nitrogen	SW-846 9056	NA	0.1	0.08	mg/L
C-007	Oil & Grease	SW-846 9071A	NA	8.0	2.5	mg/L
14265-44-2	Orthophosphate	EPA 365.2	NA	0.02	0.02	mg/L
C-021	Total Kjeldahl Nitrogen	EPA 351.2	NA	2.0	0.70	mg/L
7723-14-0	Total Phosphorus	EPA 365.1	NA	0.05	0.04	mg/L
C-020	Phenolics	SW-846 9066	NA	0.01	0.004	mg/L
C-009	Total Suspended Solids	EPA 160.2	NA	9.0	2.6	mg/L

NOTES:

(1) Fictitious CAS # assigned to Wet Chemistry parameter since an actual CAS # does not exist.

(2) SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," Third Edition.
EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020.
SM - "Standard Methods for the Examination of Water and Wastewater," (19th Edition, 1995).

(3) EDQL= Ecological Data Quality Level

(4) PQL = Practical Quantitation Limit. Sample-specific quantitation limits are highly matrix-dependent. The PQLs listed may not always be achievable. Sample-specific PQLs will be adjusted for volumes and dilutions which vary from standard procedures.

(5) MDL = Method Detection Limit. Sample-specific detection limits are highly matrix-dependent. The MDLs listed may not always be achievable. Sample-specific MDLs will be adjusted for volumes and dilutions which vary from standard procedures.

TABLE F1-3: SUMMARY OF SEDIMENT SAMPLING

Sediment Type	Depth/ Level	BTEX	PAHs and Phenols	Organochlorine Pesticides	PCBs	Herbicide 2,4-D	Metals	AVS	SEM	Grain Size	Total Phosphorus	Ammonia Nitrogen	Total Cyanide	Soluble Fluoride	Oil & Grease	pH	Total Solids	Phenolics	TKN	TOC	Total Sulfide	Soluble Sulfate	Archive[2]
Surface and Near-Surface Sediment																							
	0-10 cm	10	10	10	10	0	27	27	10	27	27	27	27	27	27	27	27	27	27	27	27	27	17
	10-20 cm	4	4	4	4	0	11	11	4	11	11	11	11	11	11	11	11	11	11	11	11	11	7
	20-30 cm	4	4	4	4	0	11	11	4	11	11	11	11	11	11	11	11	11	11	11	11	11	7
Total Surface and Near-Surface Sediments		18	18	18	18	0	49	49	18	49	49	49	49	49	49	49	49	49	49	49	49	49	31
Field Duplicate Samples (Minimum one in 10)		2	2	2	2	0	5	5	2	5	5	5	5	5	5	5	5	5	5	5	5	5	3
Equipment Blanks (Minimum one in 20)[3]		1	1	1	1	0	3	3	1	0	3	3	3	3	3	0	0	3	3	3	3	3	0
MS and MSD/LD (Minimum one in 20)		1	1	1	1	0	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	0
Deep Core Sediment Samples																							
	Upper	3	3	3	3	0	11	11	3	11	11	11	11	11	11	11	11	11	11	11	11	11	8
	Middle	3	3	3	3	0	11	11	3	11	11	11	11	11	11	11	11	11	11	11	11	11	8
	Lower	3	3	3	3	0	11	11	3	11	11	11	11	11	11	11	11	11	11	11	11	11	8
Total Deep Core Sediments		9	9	9	9	0	33	33	9	33	33	33	33	33	33	33	33	33	33	33	33	33	24
Field Duplicate Samples (Minimum one in 10)		1	1	1	1	0	4	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	3
Equipment Blanks (Minimum one in 20)		1	1	1	1	0	2	2	1	0	2	2	2	2	2	0	0	2	2	2	2	2	0
MS and MSD/LD (Minimum one in 20)		1	1	1	1	0	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	0
Wetlands Surface Sediment Samples																							
	0-10 cm	2	2	2	2	6	6	6	2	6	6	6	6	6	6	6	6	6	6	6	6	6	4
Total Wetlands Surface Sediments		2	2	2	2	6	6	6	2	6	6	6	6	6	6	6	6	6	6	6	6	6	4
Field Duplicate Samples (Minimum one in 10)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Equipment Blanks (Minimum one in 20)		1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	0
MS and MSD/LD (Minimum one in 20)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
TOTAL INVESTIGATIVE SAMPLES		29	29	29	29	6	88	88	29	88	88	88	88	88	88	88	88	88	88	88	88	88	59
TOTAL FIELD DUPLICATE SAMPLES		4	4	4	4	1	10	10	4	10	10	10	10	10	10	10	10	10	10	10	10	10	6
TOTAL EQUIPMENT BLANKS		3	3	3	3	1	6	6	3	0	6	6	6	6	6	0	0	6	6	6	6	6	0
TOTAL MS AND MSD/LD		3	3	3	3	1	6	6	3	6	6	6	6	6	6	6	6	6	6	6	6	6	0

1 Trip Blanks will be shipped at a frequency of once per shuttle containing sediment samples for BTEX analysis.

2 Archive (frozen) for possible future analysis for PAH compounds, phenols, organochlorine pesticides, and PCBs.

3 Two types of sampling equipment will be used to collect surface and near-surface sediment samples. A total of 16 investigative surface sediment samples will be collected using a grab sampler. A total of 11 surface sediment samples and 22 near surface sediment samples will be collected using a corer. Therefore, one equipment blank for grab sampling equipment and two equipment blanks for corer sampling equipment will be collected.

TABLE F1-4: SUMMARY OF SURFACE WATER SAMPLING

Sampling Period	Total Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Zn)	Dissolved Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Zn)	Fecal Coliform Bacteria	COD	BOD	Oil & Grease	Phenolics	Ammonia Nitrogen	Nitrate + Nitrite Nitrogen	TKN	Orthophosphate	Total Phosphorus	TSS	Hardness
LF1 Investigative Surface Water Samples	4	4	1	4	4	4	4	4	4	4	4	4	4	4
Field Duplicate Samples (Minimum one in 10)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Equipment Blanks (Minimum one in 20)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bottle Blank (Minimum one per event)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MS and MSD/LD (Minimum one in 20)	1	0	1	1	1	1	1	1	1	1	1	1	1	1
LF2 Investigative Surface Water Samples	4	4	1	4	4	4	4	4	4	4	4	4	4	4
Field Duplicate Samples (Minimum one in 10)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Equipment Blanks (Minimum one in 20)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bottle Blank (Minimum one per event)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
MS and MSD/LD (Minimum one in 20)	1	0	1	1	1	1	1	1	1	1	1	1	1	1

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the US EPA RCRA Project Coordinator (RPC), the DuPont Corporate Remediation Group (CRG) has overall responsibility for all phases of the SCS. All project management will be provided by DuPont CRG, with the assistance of Woodward-Clyde Diamond (WCD) and Exponent. Under DuPont CRG's supervision, WCD will oversee the field investigation, the laboratory analyses, and the data validation and Exponent will prepare the SCS report. The various quality assurance, field, laboratory, and management responsibilities of key project personnel are defined below. Environmental Standards, Inc. (Environmental Standards) of Valley Forge, Pennsylvania, will provide the quality assurance support for the project which will include the preparation of the QAPP and independent validation of data. Lancaster Laboratories of Lancaster, Pennsylvania, will provide the majority of the laboratory services for the SCS. In addition, National Environmental Testing, Inc. (NET) of Bartlett, Illinois, will provide laboratory services for several wet chemistry analyses with short holding times. The exact addresses of the project laboratories, as well as the analyses that each laboratory will be performing, have been provided in Section 7 of this QAPP.

2.1 Project Organization Chart

The lines of authority for this specific project can be found in Figure F2-1. This chart includes all individuals discussed below.

2.2 Management Responsibilities

2.2.1 US EPA RCRA Project Coordinator

The US EPA RCRA Project Coordinator (RPC), Mr. Allen Wojtas, has the overall responsibility for all phases of the SCS.

2.2.2 DuPont CRG Project Coordinator

The overall Project Coordinator for the DuPont East Chicago Site is Mr. Hilton Frey. The DuPont CRG Project Coordinator for the SCS is Mr. Frank Smith. The SCS DuPont CRG Project Coordinator's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The SCS DuPont CRG Project Coordinator will report directly to the US EPA Region 5 RPC and will provide the major point of contact and control for matters concerning the project. The SCS DuPont CRG Project Coordinator will:

- Define project objectives and develop a detailed work plan schedule;
- Maintain clear lines of communication between project team members;
- Prepare the bimonthly progress reports and QA reports; and
- Approve all reports (deliverables) before their submission to US EPA Region 5.

2.2.3 WCD Project Manager

The Woodward-Clyde Diamond (WCD) Project Manager, Mr. Alan Egler, is responsible for implementing the SCS project and has the responsibility to commit the resources necessary to meet project objectives and requirements. He has overall responsibility for ensuring that the project meets US EPA's objectives and DuPont's quality standards. The WCD Project Manager will report directly to the SCS DuPont CRG Project Coordinator and is responsible for technical quality control and project oversight. The WCD Project Manager will:

- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Orient the field leaders and support staff concerning the project's special considerations;

- Monitor and direct the Field Team Leader;
- Providing QA audit of the field operations;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Approve corrective actions and obtain the US EPA Region 5 concurrence on corrective actions, when necessary; and
- Review and analyze overall task performance with respect to planned requirements and authorizations.

2.2.4 Exponent Project Manager

The Exponent Project Manager, Dr. Lucinda Jacobs, is responsible for assuring that representative samples are collected. She will report directly to the SCS DuPont CRG Project Coordinator. She will ultimately be responsible for the preparation and quality of interim and final reports.

2.2.5 DuPont CRG Community Relations Specialists

The DuPont CRG Community Relations Specialists, Mr. Bill Stanhouse and Mr. Craig Skaggs, are responsible for all community relations activities, including representing the project team at meetings and public hearings. They will report directly to the DuPont CRG Project Coordinators.

2.3 Quality Assurance Responsibilities

2.3.1 DuPont CRG QA Manager

The DuPont CRG QA Manager, Dr. Harry Gearhart, will have direct access to DuPont CRG project management staff as necessary, to resolve any QA dispute. The DuPont

CRG QA Manager will provide assistance to the DuPont CRG Project Coordinators in terms of overseeing the writing and distribution of the QAPP to all those parties connected with the project (including the laboratory). The DuPont CRG QA Manager will be responsible for the reviewing and approving of the QAPP. He will also provide assistance to the DuPont CRG Project QA Manager in resolving any laboratory issue.

2.3.2 DuPont CRG Project QA Manager

The DuPont CRG Project QA Manager, Ms. Kim Johnson, reports directly to the DuPont CRG QA Manager. She will have primary responsibility for monitoring laboratory performance and assuring compliance with the QA/QC procedures set forth in the QAPP. She is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, DuPont's policies, and US EPA requirements. Specific functions and duties include:

- Providing QA technical assistance to project staff; and
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the SCS DuPont CRG Project Coordinator.

2.3.3 Environmental Standards QA Manager

The Environmental Standards QA Manager, Mr. David Blye, reports directly to the DuPont CRG Project QA Manager and will be responsible for ensuring that all DuPont procedures for this project are being followed. In addition, the Environmental Standards QA Manager will be responsible for the coordination of the QAPP preparation and the data validation of sample results from the analytical laboratory. Specific functions and duties include:

- Committing the necessary Environmental Standards resources to perform the QAPP preparation and data validation functions;
- Providing QA technical assistance to project staff;
- Approving Environmental Standards' project deliverables;
- Managing the project budget; and

- Overseeing the data reduction and generation of data validation reports.

2.3.4 Environmental Standards Data Validation Task Manager

The Environmental Standards Data Validation Task Manager, Ms. Meg Clark, will be responsible for preparing the QAPP. She will also be responsible for directing the validation of the analytical data collected for the investigation to determine data quality and for defining data usability. She will report directly to the Environmental Standards QA Manager. Specific responsibilities include:

- Reviewing all documents with respect to adherence of QA procedures provided in the QAPP;
- Performing and overseeing data validation for analytical data generated for the sediment and surface water samples collected for the SCS;
- Directing preparation of the quality assurance reviews for delivery to DuPont; and
- Communicating analytical deficiencies found during analysis or data validation to the Environmental Standards QA Manager and DuPont CRG Project QA Manager to initiate corrective action.

2.4 US EPA Region 5 Quality Assurance Manager (RQAM)

The US EPA RQAM, Mr. Brian Freeman, has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional US EPA responsibilities for the project include:

- Conducting external Performance and System Audits of SCS Laboratories; and
- Reviewing and evaluating analytical field and laboratory procedures

2.5 Laboratory Responsibilities

2.5.1 Laboratory Project Managers

The Lancaster Laboratories Project Manager, Ms. Nancy Bornholm, and the NET Project Manager, Ms. Mary Pearson, will report directly to the DuPont CRG Project QA Manager and will be responsible for the following at each of their respective laboratories:

- Monitoring analytical and QA project requirements;
- Assisting in the interpretation of this QAPP;
- Defining the laboratory QA procedures as appropriate for DuPont with the in-house QA Officer;
- Informing the DuPont CRG Project QA Manager of project status;
- Monitoring, reviewing, and evaluating the progress and performance of the project, thereby ensuring all resources of the laboratory are available on an as-required basis;
- Reviewing data packages for completeness of and compliance to project needs; and
- Overviewing final analytical reports.

2.5.2 Laboratory Operations Managers

The Lancaster Laboratories Operations Manager, Mr. Timothy Oostdyk, and the NET Operations Manager, Mr. Jean-Pierre Rouanet, will report to the laboratory Project Managers and, at each of their respective laboratories, will be responsible for:

- Supervising daily activities of the operational groups and QC activities performed as part of routine analytical operations;

- Coordinating laboratory analyses;
- Supervising in-house chain-of-custody;
- Scheduling sample analyses;
- Overseeing data review; and
- Overseeing preparation of analytical reports.

2.5.3 Laboratory Quality Assurance Officers

The Lancaster Laboratories QA Officer, Ms. Kathleen Loewen, and the NET QA Officer, Mr. Eric Yeggy, have the overall responsibility for data after it leaves each of their respective laboratories. The laboratory QA Officers will be independent of the laboratory but will communicate data issues through the laboratory Project Managers. In addition, the laboratory QA Officers will:

- Overview laboratory quality assurance;
- Overview QA/QC documentation;
- Conduct detailed data review;
- Determine whether to implement laboratory corrective actions, if required;
- With the associated laboratory Project Managers, define laboratory QA procedures as appropriate for DuPont;
- Oversee the preparation of the laboratory Standard Operation Procedures;
- Sign the title page of the QAPP; and
- Approve data before the third-party data validation begins.

2.5.4 Laboratory Sample Custodians

Sample Custodians will report to their laboratory's Operations Managers. Due to the large size of Lancaster Laboratories, no one person performs all the duties of a Sample Custodian. The Lancaster Laboratories Sample Administration Group acts as an organized sample custodian team. At NET, Ms. Candra Long will be the Sample Custodian. Responsibilities of the Sample Custodians will include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers and reporting anomalies to the laboratory Project Managers;
- Signing appropriate documents;
- Verifying Chain-of-Custody and its correctness;
- Maintaining Chain-of-Custody;
- Notifying laboratory Project Managers and laboratory Operations Managers of sample receipt and inspection;
- Assigning a unique identification number and customer number, and entering each into the laboratory information management system (LIMS);
- With the help of the laboratory Operations Manager, initiating transfer of the samples to appropriate laboratory sections; and
- Controlling and monitoring access/storage of samples and extracts.

Final responsibility for project quality rests with the SCS DuPont CRG Project Coordinator. Independent quality assurance will be provided by the laboratory Project Managers and QA Officers prior to release of all data to DuPont.

2.5.5 Laboratory Technical Staff

The Lancaster Laboratories and NET technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to each laboratory's Operations Manager.

2.6 Field Responsibilities

2.6.1 WCIA Field Team Leader

The WCD Project Manager will be supported by the Woodward-Clyde International Americas (WCIA) Field Team Leader, Mr. Tim Dull. The WCIA Field Team Leader is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The WCIA Field Team Leader will be accountable for all field sampling and associated documentation procedures. The WCIA Field Team Leader is a highly experienced environmental professional and will report directly to the WCD Project Manager. Specific WCIA Field Team Leader responsibilities include:

- Provision of day-to-day coordination with the WCD Project Manager on technical issues in specific areas of expertise;
- Implementing of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordinating and managing of field staff during sampling activities;
- Implementing of QC for technical data provided by the field staff including field measurement data;
- Ensuring that all field QC samples are properly collected, labeled, and shipped in the appropriate shipping containers;
- Scheduling duplicate sample submission;
- Adhering to work schedules provided by the WCD Project Manager;

- Authoring, writing, and approving of text and graphics required for field team efforts;

- Identifying problems at the field team level, resolving difficulties in consultation with the WCD Project Manager, implementing and documenting corrective action procedures, and providing communication between team and upper management; and

- Participating in preparation of the final report.

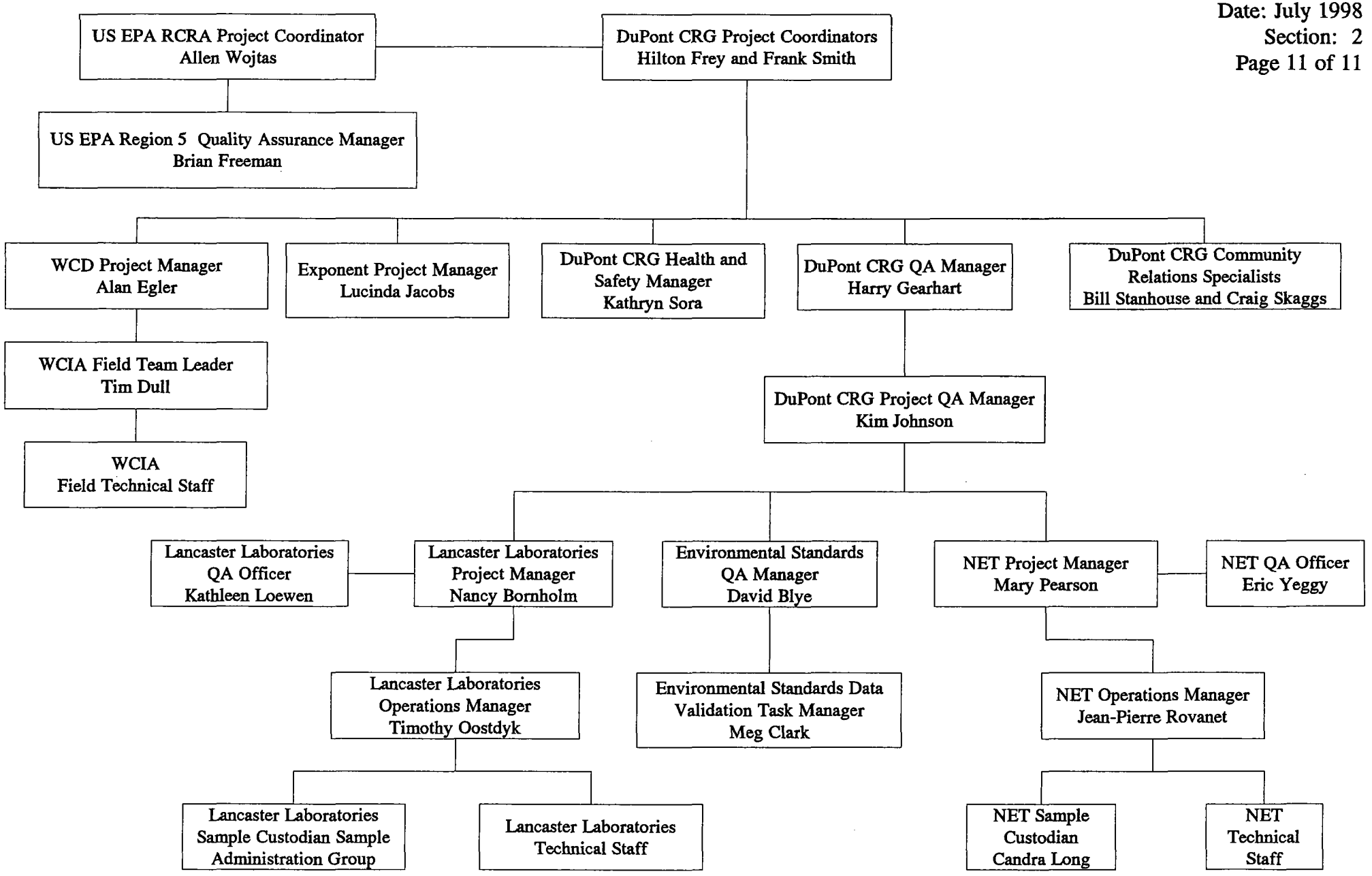
2.6.2 DuPont CRG Health and Safety Manager

The DuPont CRG Health and Safety Manager, Ms. Kathryn Sova, is responsible for the health and safety requirements for the field activities as conducted during the SCS process. She reports directly to the SCS DuPont CRG Project Coordinator.

2.6.3 WCIA Field Technical Staff

The technical staff (team members) for this project will be drawn from WCIA pool of corporate resources. The technical team staff will be utilized to gather and analyze data for preparation of various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

Figure F2-1 Project Organization Chart



SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, Chain-of-Custody, laboratory analysis, and reporting that will provide defensible data of known quality (with the exception of the archived sediment sample analyses). Specific procedures for sampling, Chain-of-Custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

Data quality and quantity are measured by the comparison of resulting data with established acceptable limits for sensitivity and data precision, accuracy, representativeness, comparability, and completeness (PARCC) as described in the US EPA document EPA/540/G-87-003 titled, "Data Quality Objectives for Remedial Response Activities." With respect to sensitivity, the method detection limits and project reporting limits for all target parameters are provided in Tables F1-1 and F1-2 in Section 1 of this QAPP. The data quality objectives (DQOs), with respect to PARCC for all samples except the archived sediment samples, are summarized in Attachment F1 to this QAPP. Data that have certain aspects that may be outside PARCC DQOs will be evaluated according to Section 3.2.3 of the above DQO document and the criteria contained in the specified analytical method, to determine what, if any, aspects of the data can be defensibly used to meet the project objective. It should be noted that sediment samples that are to be archived for possible future analysis are for informational purposes only and are not to be subject to the DQOs described in this section for the remainder of the samples collected as part of the SCS.

3.1 Precision

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement. Precision will be assessed through the calculation of relative percent differences (RPDs) for two measurements and relative standard deviations (RSDs) for three or more measurements. The equations to be used for precision in this project can be found in Section 12.2 of this QAPP.

3.1.2 Field Precision Objectives

Duplicate analyses will be performed in the field for the field parameters pH, specific conductivity, and dissolved oxygen. The DQO for duplicate precision for field parameters is indicated on Table FA1-4 in Attachment F1 to this QAPP.

Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per 10 investigative samples of a similar matrix. The total number of field duplicates for this project are found in Tables F1-3 and F1-4 of Section 1 of this QAPP. The DQO for field duplicate precision is indicated on Table FA1-1 in Attachment F1 to this QAPP.

3.1.3 Laboratory Precision Objectives

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSDs) and/or laboratory duplicates (LDs). One MS/MSD pair and/or LD will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix. The total number of MS/MSD or LDs for this project are found in Tables F1-3 and F1-4 of Section 1 of this QAPP. The DQO for MS/MSD and LD precision are indicated on Table FA1-3 in Attachment F1 to this QAPP.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

The analysis of blanks and control standards will be performed in the field for the field parameters pH, specific conductivity, and dissolved oxygen. The DQOs for blanks and control standards for field parameters are indicated in Table FA1-4 in Attachment F1 to this QAPP.

Accuracy in the field will be assessed through the use of equipment, bottle, and trip blanks (refer to Section 3.6) and ensured through the adherence to all sample handling, preservation, and holding time requirements. The equipment, bottle, and trip blanks to

be collected for this project are indicated in Tables F1-3 and F1-4 of Section 1 of this QAPP. The preservation and holding time requirements are indicated in Table B-4 of the FSP. The DQOs for equipment, bottle, and trip blanks are indicated on Table FA1-2 in Attachment F1 to this QAPP.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of MS/MSD/LDs, surrogate spikes (organics only), and laboratory control samples (LCSs) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12.1 of this QAPP. One MS/MSD pair and/or MS/LD pair will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix. The total number of MS/MSD or MS/LD pairs for this project are summarized in Tables F1-3 and F1-4 of Section 1 of this QAPP. The DQOs for MS/MSD/LD, surrogate spike, and LCS recoveries are indicated on Table FA1-3 in Attachment F1 to this QAPP.

3.3 Completeness

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid critical measurements obtained from all the field measurements planned for the project. The equation for completeness is presented in section 12.3 of this QAPP. The DQO for field completeness for this project is to be greater than 90 percent, as indicated in Table FA1-1 in Attachment F1 to this QAPP.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid critical measurements obtained from all the laboratory measurements planned for the project. The equation for completeness is presented in section 12.3 of this QAPP. The DQO for laboratory

completeness for this project is to be greater than 95 percent, as indicated in Table FA1-1 in Attachment F1 to this QAPP.

3.4 Representativeness

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. The sampling network was designed to provide data representative of the sediment within the reach of the GCR and adjacent wetlands contiguous with and downstream of the DuPont facility. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the RCRA program. The rationale of the sampling network is discussed in detail in Section 5 of the SCS Work Plan.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, attaining the quantitative DQOs, and meeting sample holding times. The holding time requirements for this project are indicated in Table B-4 of the FSP, which has been included as Appendix B to the SCS Work Plan. The quantitative DQOs are included as Attachment F1 to this QAPP. The SOPs to be used by the laboratory in the analysis of the samples collected for this project have been included at Attachments F2 - F11 to this QAPP.

Assessing the analytical results for field duplicate samples provides a direct measure of combined field and laboratory representativeness. The total number of field duplicates for this project are found in Tables F1-3 and F1-4 of Section 1 of this QAPP. The DQO for field duplicate precision is indicated on Table FA1-1 in Attachment F1 to this QAPP.

3.5 Comparability

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. The FSP has been included as Appendix B to the Work Plan. Additional information on the sampling procedures is also provided in the SOPs for the field team which have been provided as Attachment B1 to the FSP. Comparability of field data will be assessed through the evaluation of results of precision and accuracy tests. The DQOs for accuracy and precision are indicated in Tables FA1-2, FA1-3, and FA1-4 of Attachment F1 to this QAPP.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. The SOPs to be used by the laboratory have been included as Attachments F2 - F11 to this QAPP. These analytical SOPs are based on US EPA-approved methodology. Comparability of laboratory data will be assessed through the evaluation of the results of precision and accuracy tests. The DQOs for accuracy and precision are indicated in Tables FA1-2 and FA1-3 of Attachment F1 to this QAPP.

3.6 Level of Quality Control Effort

Equipment blanks, bottle blanks, trip blanks, method/preparation blanks, field duplicates, MS/MSD/LD samples and LCSs will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

Equipment blanks will be prepared by running organic-free reagent water through sampling equipment in the field after it has been decontaminated. The equipment blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Equipment blank samples are analyzed to check for

procedural contamination at the facility which may cause sample contamination. The equipment blanks will be stored with the associated sediment or surface water samples during both shipment from the field and during laboratory storage. Equipment blanks associated with sediment samples will be analyzed using a heated purge for the BTEX fraction, just like the associated sediment samples. Equipment blanks are to be collected at a frequency of once per 20 samples (with the exception of the archived sediment samples) of a similar matrix collected using the same type of sampling equipment, as indicated on Tables F1-3 and F1-4 in Section 1 of this QAPP.

Bottle blanks will be submitted to the analytical laboratories to ensure that contaminants are not originating from the bottles themselves as a result of improper preparation or handling techniques. For analysis of metals in surface water, one bottle blank per lot of prepared bottles will be submitted for analysis, as indicated on Table F1-4 in Section 1 of this QAPP.

Trip blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Trip blanks will be prepared by the laboratory and will accompany each shuttle of empty sample containers for BTEX analysis from the laboratory to the field. The filled sample containers will be repacked into the same cooler in which they were received in order to maintain the integrity of the trip blanks. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be prepared by filling two volatile vials with organic-free reagent water, with no headspace. The trip blanks will be stored with the associated sediment samples during both shipment from the field and during laboratory storage. Trip blanks will be analyzed for BTEX, using a heated purge just like the associated sediment samples, and will be shipped at a frequency of once per matrix per shuttle containing samples for BTEX analysis, as indicated on Table F1-3 in Section 1 of this QAPP.

Method/preparation blanks are generated within the laboratory and consist of all reagents specific to the method. Method blanks are carried through every aspect of the procedure, including preparation, clean-up, and analysis. Generally, the method/preparation blank is a volume of deionized water for all analyses of surface water samples and for BTEX, metals, and wet chemistry analyses of sediment samples, or sodium sulfate for PAH, phenols, pesticides, PCB, and herbicide analyses of sediment samples, with a volume approximately equal to the sample volume processed. Method/preparation blanks are used to assess contamination resulting from laboratory-made materials or procedures and are analyzed at a frequency of once per analytical batch of less than or equal to 20 samples of a similar matrix.

Field duplicate samples are to be collected and analyzed to check for sampling and analytical reproducibility. Field duplicates provide a measure of total analytical bias (field and laboratory variance) including bias resulting from the heterogeneity of the duplicate sample itself. Field duplicates will be collected at a minimum frequency of one per 10 samples of a similar matrix, as indicated on Tables F1-3 and F1-4 in Section 1 of this QAPP.

MS/MSD/LDs provide information about the effect of the sample matrix on the digestion and measurement methodology. One MS/MSD and/or MS/LD pair will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix, as indicated on Tables F1-3 and F1-4 in Section 1 of this QAPP. MS/MSD/LD analyses are to be performed on investigative samples. To account for the additional volume needed by the laboratory to perform the analyses, extra sample volumes will be required to be collected from the designated sediment or surface water location.

LCSs are laboratory-generated samples which consist of a known and well characterized matrix that is fortified with target analytes. LCSs are used to monitor the laboratory's day-to-day as well as ongoing performance of the applicable methods in terms of accuracy. LCSs are analyzed at a frequency of once per analytical batch of less than or equal to 20 samples of the same matrix.

Sampling procedures for quality control samples are specified in Section 3 of the FSP, provided as Appendix B of the SCS Work Plan.

SECTION 4

SAMPLING PROCEDURES

The sampling procedures to be used in this site investigation will be consistent with the purpose of this project. The FSP outlines all the sampling procedure information. The FSP has been included as Appendix B to the SCS Work Plan. Please refer to the following sections and subsections of the FSP for the following information:

- Establishing Station Locations Using a Differential Global Positioning System (DGPS) - Section 2.1
- Sediment Sampling Equipment - Table B-3
- Surface Water Sampling Equipment - Table B-7
- Surface Sediment Sampling Procedures - Section 2.2.1.1
- Shallow Sediment Core Sampling Procedures - Section 2.2.1.2
- Deep Sediment Core Sampling Procedures - Section 2.2.1.3
- Surface Water Sampling Procedures - Section 2.3.1
- Sample Containers and Preservation - Table B-4
- Obtaining Contaminant-Free Sample Containers - Section 6
- QC Sample Procedures - Section 3
- Equipment Blank Collection - Section 3
- Field Duplicate Collection - Section 3
- Standard Reference Material (SRM) Preparation - Section 3
- Matrix Spike/Matrix Spike Duplicate Collection - Section 3
- Bottle Blank Preparation - Section 3
- Trip Blank Preparation - Section 3
- Sediment Sampling Equipment Decontamination - Section 2.2.3
- Surface Water Sampling Equipment Decontamination - Section 2.3.3
- Sediment Sampling Order - Section 2.2.4
- Surface Water Sampling Order - Section 2.3.4
- Field Custody Procedures - Section 5
- Sample Packaging and Shipping Procedures - Section 6
- Surface Water Hydrology/Sediment Transport Evaluation - Section 2.4
- Wetlands Evaluation - Section 2.5

SECTION 5

CUSTODY PROCEDURES

The sample custody procedures outlined in this section ensure the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. Custody is one of several factors which is necessary for the generation of defensible environmental data. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under custody if:

- the item is in actual possession of a person;
- the item is in the view of the person after being in actual possession of the person;
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

5.1 Field Custody Procedures

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound, waterproof field survey books or notebooks with consecutively numbered pages. Logbooks will be assigned to field personnel and will be stored in a secure manner when not in use.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned,
- Logbook number,

- Project name,
- Project start date, and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date and time of entry, project name and location, project number, start time of sampling activity, weather conditions, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded in the logbook. All entries will be made in indelible ink, signed, and dated and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station, which includes latitude and longitude coordinate measurements as measured using a differential global positioning system (DGPS), shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Any variance from the SCS Work Plan will be described in the Field Logbook. Minor variances which will not influence the overall sampling scheme will be approved by the WCD Project Manager. Major variances which will result in a change in the numbers, types, or locations of samples will be approved by the US EPA Region 5.

Samples will be collected following the sampling procedures documented in the FSP, which has been included as Appendix B to the SCS Work Plan. The equipment used to collect samples will be noted in the logbook, along with the time of sampling, sample identification number and location, sample description (source and appearance), depth at which the sample was collected, field measurements, and the types of analyses to be performed. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples will receive a sample identification which is similar to that of the original sample with the exception that the field duplicate sample identification will also have "DUP" as part of the identification.

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. Examples of field custody documents are presented in Attachment B2 of the FSP.

(a) Lancaster Laboratories will provide the appropriate sample containers, required preservatives, and shipping containers as discussed in Section 6 of the FSP, which has been included as Appendix B to the SCS Work Plan.

(b) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(c) All containers will be identified by use of sample tags, which will be attached with wire around the container neck through a reinforced hole in the tag. Sample tags will include the field sample numbers, sampling locations, date/time of collection, name of collector, type of analysis to be performed, and preservatives added. The sample numbering system is presented in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B of the SCS Work Plan.

(d) All containers will also be identified by the use of self-adhesive sample labels, which will be affixed to each container at the laboratory prior to shipment. Sample labels will include the field sample numbers, sampling locations, date/time of collection, name of collector, type of analysis to be performed, and preservatives added.

(e) Sample tags and labels will be completed for each sample using waterproof, permanent ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag or label because the ballpoint pen would not function in freezing weather.

(f) Samples will be accompanied by a properly completed Chain-of-Custody record. The sample numbers and locations of samples to be shipped together in the same cooler will be listed on the Chain-of-Custody record. Any cooler containing a trip blank for BTEX analysis will have a laboratory-assigned identification number which will also be listed on the Chain-of-Custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a laboratory, or to/from a secure storage area.

(g) Samples will be properly packaged in insulated coolers with sufficient wet ice to maintain the preservation temperature at 4 ± 2°C (for samples requiring temperature preservation) during shipment to the laboratory. Temperature

bottle blanks will be supplied by the laboratory and placed in each cooler (for samples requiring temperature preservation) prior to shipment to the laboratory in order to provide a mechanism for measuring the temperature of the samples upon receipt at the laboratory. The sample containers will be repacked into the same sample cooler in which they were received in order to maintain the integrity of the trip blanks.

(h) Sample coolers will be shipped from the field and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. The Custody seals will be signed by the WCIA Field Team Leader or designee. Custody seals will be attached to the front right and back left of the cooler, on the edges of the lid and sides of the cooler. The custody seals will be covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

(i) All shipments will be accompanied by the Chain-of-Custody record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office.

(j) Coolers containing surface water samples to be analyzed for the short holding time analyses (fecal coliform bacteria, BOD, and orthophosphate) will be transported to NET within several hours of collection by direct courier service provided by NET. All other sample coolers will be delivered to Lancaster Laboratories by a 24-hour delivery courier (i.e., Federal Express) at the end of each day's sampling. Commercial carriers will not be required to sign off on the custody form since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact. When the samples are sent by common carrier, a bill of lading will be used. Lancaster Laboratories will retain receipts of bills of lading as part of the permanent documentation. The shipper is responsible for ensuring adherence with currect US Department of Transportation (DOT) regulations concerning the shipment of environmental samples to the project laboratory for analysis.

5.2 Laboratory Custody Procedures

Once samples are received at laboratories, the field Chain-of-Custody is completed and signed by a laboratory sample custodian, as identified in Section 2.5.4 of this QAPP. The sample

custodian will check the sample bottle tags/labels against the corresponding information listed on the field Chain-of-Custody records and note any discrepancies. Additionally, the sample custodian will note any damaged or missing sample containers. The temperature of the temperature bottle blank included in each cooler of samples requiring temperature preservation will be measured and recorded at the time of sample receipt by the sample custodian. The laboratory personnel will also check chemical preservation for all sample analyses that require addition of acid or base by recording the pH of each sample container after the sample login process (all parameters except volatiles) or at the time of analysis (volatiles). This information will be recorded in a separate logbook. Any discrepancies in sample identifications, sample analysis information, indication that samples are missing upon receipt at the laboratory, or indication that samples not received at the correct pH or temperature (4° ± 2°C) will be communicated to the DuPont CRG Project QA Manager within 24 hours of sample receipt so that appropriate corrective action can be determined and implemented.

After the sample receipt information is checked and recorded, sample analysis information will be entered into each laboratory's laboratory information management system (LIMS). Each sample will be provided a unique laboratory identification number (Lancaster Laboratories assigns a sequential seven-digit number with a two letter sample-matrix prefix) and the analysis tests requested on the Chain-of-Custody records entered into the LIMS. Lancaster Laboratories uses their computerized system to track the custody of each sample by its unique laboratory identification number from the time of receipt through the time of disposal. In addition, after the required information has been entered into the LIMS, an internal laboratory Chain-of-Custody will be initiated by Lancaster Laboratories sample admininistration personnel. For Lancaster Laboratories, the internal Chain-of-Custody procedures will be as described in Lancaster Laboratories SOP-QA-104.02, "Quality Assurance Operations Manual, Internal Chain-of-Cusody Documentation," which has been included as Attachment F12 to this QAPP. This internal Chain-of-Custody (examples of Lancaster Laboratories' internal Chain-of-Custody are included in SOP-QA-104.02) will document the transfer of samples from the storage location to the analyst for analysis and subsequently through final disposition at the laboratory. Internal Chain-of-Custody documentation will not be used by NET since it is not available at this NET facility and the analyses being performed by NET are not considered critical analysis fractions. Once samples are received at NET, the samples are considered to be within the custody of the NET laboratory facility. Within the NET facility, the samples are stored in a secure area when not in the possession/custody of an individual NET staff member. The custody and integrity of the samples are maintained by limiting access to the laboratory through a monitored reception area and escorting all visitors to the NET facility at all times. These procedures are described in NET's SOP entitled "Procedure for Chain of Custody," which has also been included in Attachment F12 to this QAPP.

At each laboratory, samples will be stored in secure, limited access areas in an environment that maintains any required temperature preservation. Samples for most analyses are required to be refrigerated at a temperature of 4 ± 2° C. The temperature of the refrigerators used to store samples will be monitored by the project laboratories. Samples which do not require temperature preservation will be stored at room temperature. All samples except the archived sediment samples will be analyzed as soon as possible within the maximum holding times. Maximum sample holding times are stipulated in Table B-4 of the FSP, which has been included as Appendix B to the SCS Work Plan. Sediment samples which are designated to be archived for possible future analyis for informational purposes only will be placed in an outer plastic bag to avoid cross-contamination if breakage should occur. The archived samples will be stored at Lancaster Laboratories in freezer storage maintained at a temperature of -10 ± 5°C. The archived samples will be held in this condition by Lancaster Laboratories until authorization by the SCS DuPont CRG Project Coordinator to begin analysis. Disposal of unused raw sample volumes, sample extracts, and sample digestates will be in accordance with each laboratory's waste management policys. Disposal of raw samples will occur after 30 days from the date the analysis report was issued. Sample extracts and sample digestates will also be held for a period of 30 days from the date the report was issued.

Any data recorded manually will be collected in notebooks. Any data resulting from instrument printouts will be dated and will contain the signature and/or identification of the analyst responsible for its generation. In addition, each laboratory will maintain a project file, which will contain Chain-of-Custody records as well as other project documentation/ communications. Copies of the raw data and internal (Lancaster Laboratories only) and field Chain-of-Custody records, as well as other project documentation (refer to Table F9-3 in Section 9 for the required laboratory data package deliverables), will be incorporated into each labortory's data package deliverables.

5.3 Final Evidence Files

DuPont, WCD, WCIA, Lancaster Laboratories, NET, and Environmental Standards are the custodians of the evidence file and maintain the contents of evidence files for the SCS, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area and under custody of the each contractor's project manager. Prior to disposal of the files by each of the subcontractors according to their individual data retention policies, the SCS DuPont CRG Project Coordinator will be notified in writing and offered custody of the final evidence files. Otherwise, the contents of the final evidence file will be retained in each contractor's facility until directed by DuPont to purge their files and provide the files to DuPont.

DuPont will ensure the retention of all reports, records, or other documents for a period of at least six years after the termiantion of the pendency of the Corrective Action Order. Ninety days prior to disposal of any documentation maintained in the final evidence file at the direction of DuPont, the US EPA Region 5 will be notified in writing and offered custody of the fianl evidence file documentation. Such written notification will reference the effective date, caption, and docket number of the Corrective Action Order and will be addressed to:

Director, Waste Pesticides & Toxics Division
US EPA, Region 5
77 West Jackson Boulevard, D-8J
Chicago, Illinois 60604-3590

The final evidence file will include at a minimum:

- field logbooks;
- field data and data deliverables;
- photographs;
- drawings;
- laboratory data deliverables;
- data validation reports;
- data assessment reports;
- progress reports, QA reports, interim project reports, etc.; and
- all custody documentation (tags, forms, airbills)

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 Field Instrument Calibration

The field instruments will be calibrated as described in the field SOPs or as described below. Field instruments include a pH meter, a thermometer, a conductivity meter, a dissolved oxygen meter, a stream flow meter, and a water level recorder. As a rule, instruments will be calibrated daily prior to use. For specific instructions on the calibration frequency, the acceptance criteria, and the conditions that will require more frequent recalibration, refer to the specific SOPs (which have been included in Attachment B1 to the FSP) for each field analysis.

If applicable to the measurements, the linearity of the instrument will be checked by using a 2-point calibration with reference standards bracketing the expected measurement. All the calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

6.1.1 Flow Meter and Surface Water Elevation Calibration

Strict operator calibration procedures do not exist for measuring flow or surface water elevation. Calibration of the Marsh-McBirney flow meter is set at the factory by the manufacturer. A quick test of the instrument operation will be performed by holding the flow meter in a bucket of water for a zero flow rate, then moving it around to verify that it provides a response. If no response occurs, corrective action will be performed which will consist of verifying that the sensors are clean and checking the condition of the batteries.

Surface water elevation accuracy will be determined against a surveyed control datum which will be measured to the nearest 0.01 feet.

6.2 Laboratory Instrument Calibration

Calibration procedures for a specific laboratory instrument will consist of initial calibration (2 to 5-points), initial calibration verification and continuing calibration verification. For a description of the calibration procedures for a specific laboratory instrument, refer to the applicable SOPs in Attachments F2 - F11 of this QAPP. Table F6-1 provides a summary of the calibration frequency, criteria, and corrective action that can be found in each of the applicable SOPs. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, number and type of calibration solutions run, and the samples associated with these calibrations.

Table F6-1: CALIBRATION PROCEDURES

		Initial Calibration			Continuing Calibration Verification			
Parameter(s)/ Parameter Group	Analytical Method	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria	Corrective Action
BTEX	SW-846 8260B	After C-Cal fails	6	RF for SPCCs >0.300 for chlorobenzene and 1,2,2-tetrachloroethane, and >0.100 for 1,1-dichloroethene, bromoform, and chloromethane. Max %RSD for CCC's <30%*	Every 12 hours	1	RF for SPCCs >0.300 except for bromoform >0.10 %Drift for CCCs <20%	Recalibrate Instrument
PAHs and Phenols	SW-846 8270C	After C-Cal fails	6	RF for SPCC's >0.050 Max %RSD for CCC's <30%*	Every 12 hours	1	RF for SPCCs >0.050 %Drift for CCCs <20%	Recalibrate Instrument
Organochlorine Pesticides/PCBs/ Herbicides	SW-846 8081A, 8082, 8151A	Each new run and After C-cal fails	5	20% RSD of RFs of initial calibration to use avg. RF, otherwise use curve fit. Alternatively, if the average of the %RSDs of all compounds in the calibration standard is ≤20%, then the AVG RF can be used for all compounds. Degradation for DDT, endrin 15% (SW-846 8081A only)	Every 10 samples and Every 20 samples or 12 hours for SW-846 8081A, 8082	1	≤15% difference from initial response for quantitation C-Cal - A CCV is also compliant if the average RPD is ≤15% for all compounds in the CCV standard. DDT/Endrin breakdown check 15% every 12 hours or 20 injections (SW-846 8081A only)	Recalibrate Instrument
Metals and SEM Metals except Mercury by ICP (trace)	SW-846 6010B	Each new run	1	Independent calibration verification within ±10%, standards <5%RSD	Every 10 samples	1	Same as initial	Recalibrate Instrument
Mercury and SEM Mercury	SW-846 7470A, 7471A	Each new run	5	Independent calibration verification within ±10% Correlation coefficient >0.995	Every 10 samples	1	±20% of true value	Recalibrate Instrument
Arsenic and Lead by GFAA	SW-846 7060A, 7421	Each new run	5	Independent calibration verification within ±10% Correlation coefficient >0.995	Every 10 samples	1	±20% of true value	Recalibrate Instrument
Acid Volatile Sulfides	EPA/821-R-91-100	Daily	5	Correlation coefficient >0.995	N/A	N/A	N/A	Recalibrate Instrument
Total Cyanide, Phenolics, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus	SW-846 9012A, 9066; EPA 350.1, 351.2, 365.1	Daily	6	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value	Recalibrate Instrument

		Initial Calibration			Continuing Calibration Verification			
Parameter(s)/ Parameter Group	Analytical Method	Frequency	# Std Conc	Acceptance Criteria	Frequency	# Std Conc	Acceptance Criteria	Corrective Action
Soluble Fluoride, Soluble Sulfate, Nitrate/Nitrite Nitrogen	SW-846 9056	After C-Cal fails or every 5 days	5	Correlation coefficient >0.995	Every 10 samples	1	±10% of true value	Recalibrate Instrument
Total Sulfide	SW-846 9030B/9034	Weekly Standardization of Titrant	1	Calculate Normality	NA	NA	NA	NA
Chemical Oxygen Demand	EPA 410.4	Quarterly or with a new lot of digestion vials	5	Correlation coefficient >0.995	Daily	1	93 - 105 %	Recalibrate Instrument
Total Organic Carbon	EPA 415.1	Daily	5	±10% @ STD	Every 10 samples	1	±10% of true value	Recalibrate Instrument
pH	SW-846 9045C	Daily	3	pH4: 3.86 - 4.14 pH units pH7: 6.86 - 7.14 pH units pH10: 9.86 - 10.14 pH units	Every 10 samples	1	97 - 103 %	Recalibrate Instrument
Total Hardness	EPA 130.2	Daily Standardization of Titrant	1	Calculate Normaility	NA	NA	NA	NA
Oil & Grease, Total Solids, Grain Size, Total Suspended Solids	SW-846 9071A, EPA 160.3, ASTM D422-63, EPA 160.2	Daily	4	Top-loading balance ±.5% Analytical balances ± .1% for weights >.1 g .05 g ± .5% .02 g ± 1.0% .01 g ± 2.0% .005 g ± 2.0%	NA	NA	NA	Recalibrate Instrument
Fecal Coliform Bacteria	SM 9221C	2x/day	1	44.5±0.2°C	NA	NA	NA	NA
Biochemical Oxygen Demand	EPA 405.1	Each new run	1	Adjust calibration knob to appropriate DO atmospheric factor	Weekly	1	± 10% of true value	NA
Orthophosphate	EPA 365.2	Daily	5	Correlation coefficient >0.995	Daily	1	± 10% of true value	Recalibrate the Instrument

*All compounds with %RSD >15 must use first or second order regression fit of the six calibration points. Alternatively, if average of the %RSD of all compounds in calibration standard is ≤15%, the AVG RF can be used for all compounds.

Abbreviations
Std Conc - The number of standard concentrations used
SPCCs - System performance check compounds
CCCs - Calibration check compounds
RF - Response factor
%RSD - Percent relative standard deviation
C-Cal - Continuing calibration
ICP - Inductively coupled plasma spectrophotometer; ICP run also includes interelement correction check standard (beginning and end of run)
GFAA - Graphite furnace atomic absorption spectrophotometer

SECTION 7

ANALYTICAL PROCEDURES

Sediment and surface water samples collected during field sampling activities for the DuPont East Chicago SCS, with the exception of surface water samples collected for wet chemistry analyses with short holding times (≤48 hours), will be analyzed by Lancaster Laboratories of Lancaster, Pennsylvania. The surface water samples collected for wet chemistry analyses with short holding times (≤48 hours) will be analyzed by NET of Bartlett, Illinois. The addresses and telephone numbers for these laboratories are provided below.

1. All laboratory parameters except wet chemistry with ≤48 hour holding times in surface water:
   Lancaster Laboratories
   2425 Holland Pike
   Lancaster, Pennsylvania 17601-5994
   Tel: (717) 656-2300

2. Wet chemistry with ≤48 hour holding times in surface water:
   NET
   850 West Bartlett Rd.
   Bartlett, Illinois 60103
   Tel: (630) 289-3100

7.1 Field Measurement Procedures

The standardization and QA information for field measurements of pH, specific conductivity, temperature, dissolved oxygen, stream flow, and surface water elevation are described in Sections 3 and 6 of this QAPP. SOPs for these analyses have been included in Attachment B1 to the FSP.

7.2 Laboratory Analytical Procedures

The laboratories named above will implement the project-required SOPs, which have been included as Attachments F2 - F11 to this QAPP. These laboratory SOPs for sample preparation, cleanup, and analysis are based on *"Test Methods for Evaluating Solid Waste,*

Physical/Chemical Methods (SW-846) Third Edition" (Final Update III, December 1996), EPA-600/4-79-020 *"Methods for Chemical Analysis of Water and Wastes"* (March 1983), EPA/600/R-93/100 *"Methods for the Determination of Inorganic Substances in Environmental Samples"* (August 1993), *"Standard Methods for the Examination of Water and Wastewater"* (19th Edition, 1995), and *"American Society for Testing and Materials (ASTM) Annual Book of Standards."* These SOPs provide sufficient detail to perform the analyses and are specific to this SCS.

Table F7-1 summarizes the EPA method references and corresponding laboratory SOP numbers for the analysis procedures to be used for each analytical parameter group in the sediment and aqueous (aqueous blanks or surface water) matrices to be evaluated in this investigation. For samples requiring both pesticide and PCB analyses, the samples will first be analyzed for pesticides and PCBs together using SW-846 Method 8081A with PCB calibration according to SW-846 Method 8082 in the same analytical sequence. Since some PCB peaks may co-elute or overlap with the pesticide peaks of interest, the joint calibration allows for better interpretation of the peaks observed for each sample. This practice will allow for quantitation of the same peak for two different parameters to be avoided/qualified. If a sample analysis exhibits flat baselines or just a small number of distinct peaks, the joint analysis will be deemed sufficient to cover both the pesticide and PCB analyses. However, if significant matrix interference is observed for any sample, Lancaster Laboratories will perform a separate PCB analysis of a sulfuric acid-treated fraction of the sample extract in accordance with SW-846 Method 8082 to identify and quantitate PCBs. Many of the sediment and surface water samples may contain matter (e.g., high oil and grease content, etc.) that could interfere with a number of the analyses, as discussed in Section 1.4.2 of this QAPP. If significant interferences are observed by the analyst for the ICP analyses for arsenic and/or lead, secondary analyses for these analytes may be performed by graphite furnace atomic absorption by the analytical methods listed in Table F7-1. These situations will be brought to the attention of the Environmental Standards Data Validation Task Manager for discussion with the SCS project team so that the alternate methods may be used, if appropriate.

The preparation and organic cleanup methods and corresponding laboratory SOP numbers are also provided in Table F7-1. Sulfuric acid cleanup (SW-846 Method 3665A) will be used for all PCB-only analyses. As previously stated, many of the sediment and surface water samples may contain matter (e.g., high oil and grease content) that could interfere with a number of the analyses, (this is discussed in Section 1.4.2 of this QAPP). Therefore, the cleanup procedures listed in Table F7-1 will be used if deemed necessary by the analyst to remove interfering

peaks and/or to remove materials that may cause deterioration and/or loss of detector sensitivity.

The SOPs listed in Table F7-1 are provided in Attachments F2 - F11, as also specified in Table F7-1.

Lancaster Laboratories SOPs on "Validation and Authorization of Analytical Methods" (Lancaster Laboratories SOP-QA-106.01) and "Determining Method Detection Limits and Limits of Quantitation" (Lancaster Laboratories SOP-LA-034) have been provided in Attachment F13 of this QAPP.

7.2.1 List of Project Target Compounds and Laboratory Detection Limits

A complete listing of project target compounds, PQLs, and current laboratory-determined MDLs for each analyte group listed in Table F7-1 can be found in Tables F1-1 and F1-2 of this QAPP. The surface water samples will be analyzed for both total and dissolved metals for the metals listed on Table F1-2. MDLs shown have been experimentally determined using the method found in the 40 CFR Part 136, Appendix B.

7.2.2 List of Associated QC Samples

The definitions and frequency for QC samples with respect to PARCC are stated in Section 3 of this QAPP. The laboratory preparation and analysis SOPs include a "Quality Assurance" or "Quality Control" section which addresses the minimum QC requirements for the analysis of specific analyte groups. The QC requirements addressed in these SOPs are summarized in Table F7-2.

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
BTEX	SW-846 5035	Preparation	Solid	AL-VOA-01	F2
	SW-846 8260B	Analysis	Aqueous	AL-VOA-02	F2
	SW-846 8260B	Analysis	Solid	AL-VOA-03	F2
PAHs and Phenols	SW-846 3510C	Preparation	Aqueous	AL-BNA-01	F3
	SW-846 3550B	Preparation	Solid (Low-Level)	AL-BNA-02	F3
	SW-846 3550B	Preparation	Solid (Medium-Level)	AL-BNA-03	F3
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-BNA-04	F3
	SW-846 8270C	Analysis	Aqueous/Solid	AL-BNA-05	F3
Organochlorine	SW-846 3510C	Preparation	Aqueous	AL-PP-01	F4
Pesticides/PCBs	SW-846 3550B	Preparation	Solid	AL-PP-02	F4
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-PP-03	F4
	SW-846 3660B	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 3630C	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 3620B	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 8081A/8082	Analysis	Aqueous	AL-OCPP-01	F4
	SW-846 8081A/8082	Analysis	Solid	AL-OCPP-02	F4
PCBs only	SW-846 3665A	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 8082	Analysis	Aqueous	AL-PCB-01	F4
	SW-846 8082	Analysis	Solid	AL-PCB-02	F4
Organochlorine Herbicide	SW-846 3510C/8151A	Preparation	Aqueous	AL-OCH-01	F5
2,4-D	SW-846 3550B/8151A	Preparation	Solid	AL-OCH-02	F5
	SW-846 8151A	Analysis	Aqueous	AL-OCH-03	F5
	SW-846 8151A	Analysis	Solid	AL-OCH-04	F5
Organochlorine	SW-846 8000 series	Calibration	Aqueous/Solid	AL-GC-01	F6
Pesticides/PCBs/	SW-846 8000 series	Chromatography	Aqueous/Solid	AL-GC-02	F6
Herbicide	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-03	F6
	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-04	F6
	SW-846 8000 series	Data Review	Aqueous/Solid	AL-GC-05	F6
Metals except	SW-846 3010A	Preparation	Aqueous	AL-MET-01	F7
Mercury by ICP	SW-846 3050B	Preparation	Solid	AL-MET-02	F7
(trace)	SW-846 3010A/3050B/6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-23	F7
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-24	F7
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7
	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7
Simultaneously	EPA/821-R-91-100	Preparation	Aqueous/Solid	AL-WET-01	F10
Extracted Metals except	SW-846 6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
Mercury by	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-23	F7
ICP (trace)	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-24	F7
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7
	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
Mercury	SW-846 7470A	Preparation	Aqueous	AL-MET-06	F8
	SW-846 7470A	Preparation	Aqueous	AL-MET-07	F8
	SW-846 7471A	Preparation	Solid	AL-MET-08	F8
	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Simultaneously Extracted Mercury	EPA/821-R-91-100	Preparation	Aqueous/Solid	AL-WET-01	F10
	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Arsenic and Lead by GFAA	SW-846 3020A	Preparation	Aqueous	AL-MET-14	F9
	SW-846 3050B	Preparation	Solid	AL-MET-15	F9
	SW-846 3000/7000 series	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7000 series GFAA	Quality Control	Aqueous/Solid	AL-MET-22	F9
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-16	F9
Lead by GFAA	SW-846 7421	Analysis	Aqueous/Solid	AL-MET-17	F9
Arsenic and Lead by GFAA	SW-846 7060A/7421	Analysis	Aqueous/Solid	AL-MET-20	F9
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-21	F9
Acid Volatile Sulfides	EPA/821-R-91-100	All	Aqueous/Solid	AL-WET-01	F10
Total Cyanide, Phenolics, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus	SW-846 9012A, 9066 EPA 350.1, 351.2, 365.1	Quality Control	Aqueous/Solid	AL-WET-02	F10
Total Cyanide	SW-846 9012A	Preparation	Aqueous/Solid	AL-WET-03	F10
	SW-846 9012A	Analysis	Aqueous/Solid	AL-WET-04	F10
Oil & Grease	SW-846 9071A	All	Aqueous	AL-WET-05	F10
	SW-846 9071A	All	Solid	AL-WET-06	F10
Phenolics	SW-846 9065	Preparation	Aqueous/Solid	AL-WET-07	F10
	SW-846 9066	Analysis	Aqueous/Solid	AL-WET-08	F10
Soluble Fluoride and Soluble Sulfate	SW-846 9056	Preparation	Solid	AL-WET-09	F10
Soluble Fluoride, Soluble Sulfate, and Nitrate/Nitrite Nitrogen	SW-846 9056	Analysis	Aqueous/Solid	AL-WET-10	F10
Total Sulfide	SW-846 9030B/9034	All	Aqueous/Solid	AL-WET-11	F10

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
Ammonia Nitrogen	EPA 350.2	Preparation	Solid	AL-WET-12	F10
	EPA 350.1	Analysis	Aqueous/Solid	AL-WET-13	F10
Total Kjeldahl Nitrogen	EPA 351.2	Preparation	Aqueous	AL-WET-14	F10
	EPA 351.2	Preparation	Solid	AL-WET-15	F10
	EPA 351.2	Analysis	Aqueous/Solid	AL-WET-16	F10
Total Phosphorus	EPA 365.1	All	Aqueous/Solid	AL-WET-17	F10
pH	SW-846 9045C	Calibration	Solid	AL-WET-18	F10
	SW-846 9045C	Analysis	Solid	AL-WET-19	F10
Total Organic Carbon (Soluble)	EPA 415.1	All	Aqueous	AL-WET-20	F10
	EPA 415.1	All	Solid	AL-WET-21	F10
Total Solids	EPA 160.3	All	Solid	AL-WET-22	F10
Grain Size	ASTM D422-63	All	Solid	AL-WET-23	F10
Chemical Oxygen Demand	EPA 410.4	All	Aqueous	AL-WET-24	F10
Total Suspended Solids	EPA 160.2	All	Aqueous	AL-WET-25	F10
Hardness	EPA 130.2	All	Aqueous	AL-WET-26	F10
Oil & Grease, Total Solids, Total Suspended Solids, Grain Size	ASTM E617-91	Calibration	Aqueous/Solids	AL-WET-30	F10
Fecal Coliform Bacteria	SM 9221C	All	Aqueous	AL-WET-27	F11
Biochemical Oxygen Demand	EPA 405.1	All	Aqueous	AL-WET-28	F11
Orthophosphate	EPA 365.2	All	Aqueous	AL-WET-29	F11

TABLE F7-2: QUALITY CONTROL PROCEDURES

TYPE	ACCEPTANCE LIMITS(%)	FREQUENCY	CORRECTIVE ACTION
BTEX (SW-846 8260B)			
Surrogates: Toluene-d_8 Bromofluorobenzene 1,2-Dichloroethane-d_4 Dibromofluoromethane	Refer to Table FA1-2 in Attachment F1 to this QAPP	Each sample, MS, MSD, LCS, and blank	Reanalyze sample if outside limits; if reanalysis confirms original, document on report and/or case narrative
Matrix Spikes: All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) of samples per matrix/level	LCS run for compounds outside acceptance limits
Laboratory Control Samples: All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) of samples per matrix/level	Reanalyze LCS and associated samples for compounds outside acceptance limits that are also outside MS/MSD acceptance limits
Matrix Spike Duplicates (RPD): All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks	Refer to Table FA1-2 in Attachment F1 to this QAPP	Once for each 12-hour time period	Reanalyze blank and associated samples if blank outside limits
Internal Standards: Bromochloromethane 1,4-Difluorobenzene Chlorobenzene-d_5	-50% to +100% of internal standard area of 12-hour STD RT Change ≤30 sec.	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report or case narrative
PAHs and Phenols (SW-846 8270C)			
Surrogate: Nitrobenzene-d_5 2-Fluorobiphenyl Terphenyl-d_{14} Phenol-d_6 2-Fluorophenol 2,4,6-Tribromophenol	Refer to Table FA1-2 in Attachment F1 to this QAPP	Each sample, MS, MSD, LCS, and blank	Repeat extraction and analysis; if reanalysis confirms originals, document on report and/or case narrative
Matrix Spikes: All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Laboratory Control Sample: All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits
Matrix Spike Duplicates (RPD): Same as for matrix spikes	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results

TABLE F7-2: QUALITY CONTROL PROCEDURES

TYPE	ACCEPTANCE LIMITS(%)	FREQUENCY	CORRECTIVE ACTION
PAHs and Phenols (SW-846 8270C) Continued			
Blanks	Refer to Table FA1-2 in Attachment F1 to this QAPP	Once per case or group (≤20) of samples, each matrix, level, instrument	Re-extract and reanalyze blank and associated samples
Internal Standards: 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}	-50 to +100 of internal standard area of 12-hour STD RT change ≤30 sec.	Each sample, MS, MSD, LCS, and blank	Reanalyze samples; if reanalysis confirms original, document on report and/or case narrative
Organochlorine Pesticide/PCBs/Herbicides (SW-846 8081A/8082/8151A)			
Surrogate: Organochlorine Pesticides and PCBs; DCB and TCMX Organochlorine Herbicides; DCAA	Refer to Table FA1-2 in Attachment F1 to this QAPP	Added to each sample, MS/MSD, blank, LCS/LCSD during the extraction phase	At least one surrogate must be in spec unless matrix related problems are evident; if matrix related problems are evident, report results and comment in case narrative
Matrix Spikes: Organochlorine Pesticides; All compounds of interest, except toxaphene Organochlorine PCBs; Aroclors 1016 and 1260 Organochlorine Herbicides; All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each extraction group (≤20) of samples per matrix/level	Run LCS for compounds outside acceptance limits
Laboratory Control Sample: Organochlorine Pesticides; All compounds of interest, except toxaphene Organochlorine PCBs; Aroclors 1016 and 1260 Organochlorine Herbicides; All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (≤20) when MS/MSD falls outside established limits	Re-extract and reanalyze LCS and associated samples for compounds outside acceptance limits

TABLE F7-2: QUALITY CONTROL PROCEDURES

TYPE	ACCEPTANCE LIMITS(%)	FREQUENCY	CORRECTIVE ACTION
Organochlorine Pesticide/PCBs/Herbicides (SW-846 8081A/8082/8151A) Continued			
Matrix Spike Duplicates (RPD): Organochlorine Pesticides; All compounds of interest, except toxaphene Organochlorine PCBs; Aroclors 1016 and 1260 Organochlorine Herbicides; All compounds of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group (20) of samples per matrix/level	Evaluated by analyst in relationship to other QC results
Blanks	Refer to Table FA1-2 in Attachment F1 to this QAPP	Once per case or extraction group (≤20) of samples, each matrix, level, instrument	Inject a hexane or solvent blank first to be sure the analytical system is clean then reinject the blank itself. If the reinjected blank is acceptable, any samples extracted with this blank should be reinjected if they, too, contain the analyte which was contaminating the blank. If the reinjected blank is unacceptable, any affected samples must be reextracted.
Metals (SW-846 6010B/7470A/7471A/7060A/7421)			
Matrix Spikes: All analytes of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (≤20) each method	Analyze post-digestion spike sample
Matrix Spike Duplicate (RPD): All analytes of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (20) each method	Analyze post-digestion spike sample if not already run for MS, flag the data
Duplicates (RPD)	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (≤20) each method	Flag the data

TABLE F7-2: QUALITY CONTROL PROCEDURES

TYPE	ACCEPTANCE LIMITS(%)	FREQUENCY	CORRECTIVE ACTION
Metals (SW-846 6010B/7470A/7471A/7060A/7421) Continued			
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	**ICP:** <3× IDL or blank <1/10 conc. of action level and samples not ±10% of action level **AA:** <LOQ	Each wavelength immediately after calibration verification at 10% frequency or every 2 hours (beginning and end of run min.)	Correct problem, recalibrate, and rerun
Preparation Blank	Refer to Table FA1-2 in Attachment F1 to this QAPP	Each SDG or batch (≤20 samples)	Redigest and reanalyze blank and associated samples if sample result <20× blank result
Serial Dilutions (ICP & GFAA only)	Within ±10% of the original determination	Each group of (≤20) of similar matrix/level	Flag the data
Interference Check Sample (ICP only)	±20% of the true value for the analytes	Each wavelength after Initial Calibration Verification at beginning and end of the run or min. of 2× per 8 hour	Recalibrate the instrument
Laboratory Control Sample	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each SDG or batch (≤20 samples), each method	Redigest and reanalyze LCS and associated samples
Post Digestion Spike	**GFAA:** 85% to 115% **ICP:** 75% to 125%	When matrix spikes are outside 80% to 120% range	Perform Method of Standard Additions for Batch Flag the data
Wet Chemistry (The following QC performed as applicable to the specific method)			
Matrix Spikes: All analytes of interest	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (≤20) each method	Flag the data
Matrix Spike Duplicate (RPD): All parameters of interest possible	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (20) each method	Flag the data
Duplicates (RPD)	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each group of samples of similar matrix/level (≤20) each method	Flag the data

TABLE F7-2: QUALITY CONTROL PROCEDURES

TYPE	ACCEPTANCE LIMITS(%)	FREQUENCY	CORRECTIVE ACTION
Wet Chemistry (The following QC performed as applicable to the specific method) Continued			
Blanks: Initial Calibration (ICB) Continuing Calibration (CCB)	<LOQ	Immediately after calibration verification	Correct problem, recalibrate, and rerun
Preparation Blank	Refer to Table FA1-2 in Attachment F1 to this QAPP	Each SDG or batch (≤20 samples)	Reprepare and reanalyze blank and associated samples
Laboratory Control Sample: All parameters of interest possible	Refer to Table FA1-3 in Attachment F1 to this QAPP	Each SDG or batch (≤20 samples), each method	Reprepare and reanalyze LCS and associated samples

SECTION 8

INTERNAL QUALITY CONTROL CHECKS

QC checks are operational techniques and activities that are used to fulfill the requirements of QA policies. QC is an integrated system of activities in the areas of quality planning, quality assessment, and quality improvement. These activities are included to provide the program with a measurable assurance that the required standards of quality are met. The intent of the internal quality control program is to detect potential problems at the source and, if necessary, trace the sample analytical pathways for introduction of contamination. The quality control data generated in the field will be used to monitor sampling technique, reproducibility, and cleanliness. Quality control data generated by the laboratory will monitor not only reproducibility (precision) in the laboratory methods and cleanliness but also accuracy in samples submitted for analysis. During the data validation process, variability in sampling technique and laboratory performance will be assessed separately. The interrelation of these QC checks is described in the subsections that follow.

8.1 Field Quality Control Checks

QC procedures for pH, specific conductance, temperature, dissolved oxygen, stream flow, and water elevation measurements of surface water samples will include calibrating the instruments, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. The QC information with respect to the calibration of field equipment is stated in Section 6 of this QAPP. The QC information for field equipment with respect to PARCC is stated in Section 3 of this QAPP. The thermometer used will be compared to a NIST-traceable thermometer (or equivalent). Sediment color checks will be done using Munsell color charts. The results of all QC analyses and any corrective actions performed for the field parameters will be recorded in the field logbooks.

To achieve the overall data quality objectives, proper sample collection and handling procedures must be followed. The sample collection and handling procedures are documented in the FSP, included as Appendix B to the Work Plan. Assessment of field sampling precision and bias will be made by collecting field duplicates, MS/MSD samples, trip blanks, bottle blanks, and equipment blanks for laboratory analysis. Definitions and the frequency requirements for each QC sample type is discussed in Section 3 of this QAPP. The QC frequency is also summarized on Tables F1-3 and F1-4 in Section 1 of this QAPP. Collection

of these QC samples will be in accordance with the applicable procedures in Section 2 of the FSP.

8.2 Laboratory Quality Control Checks

The laboratories identified in Section 7 of this QAPP have QC programs that each laboratory uses to ensure the reliability and validity of the analysis performed at that particular laboratory. All analytical procedures are documented in writing as SOPs, and each SOP includes a "Quality Assurance" or "Quality Control" section which addresses the minimum QC requirements for the procedure. The QC requirements addressed in these SOPs are summarized in Table F7-2 in Section 7 of this QAPP. The internal quality control checks might differ slightly for each individual analytical procedure but in general the QC requirements include the following:

- A minimum of one procedural blank (method/preparation blank) in every 20 samples of a similar matrix analyzed to detect contamination;

- A minimum of one matrix spike/matrix spike duplicate pair or matrix spike/laboratory duplicate per every 20 samples to determine accuracy, precision, and the presence of matrix effects;

- Surrogate spikes for organic analyses to determine recoveries and to account for sample-to-sample variation;

- A minimum of one laboratory control standard for every batch of less than or equal to 20 samples of a similar matrix to determine recovery;

- Multilevel initial calibration of instruments to establish calibration curves plus the analysis continuing calibration standards (organics) for accurate quantitation or calibration verifications (metals and general chemistry), and recalibration if these do not meet criteria;

- Mass tuning for GC/MS systems every 12 hours to meet SOP criteria using the compound bromofluorobenzene (BFB) for BTEX and the compound decafluorotriphenylphosphine (DFTPP) for PAH and phenol analysis;

- Internal standard areas for gas chromatography/mass spectrometry (GC/MS) analysis to quantitate results and to account for sample-to-sample variation;

- Endrin/DDT degradation check for pesticide analysis by gas chromatography/electron capture detector analysis (GC/ECD) to measure the decomposition of endrin and DDT into breakdown components;

- Analysis on a second, dissimilar GC column analysis by GC/ECD for qualitative confirmation;

- Calibration blanks for metals analysis prior to and between the analysis of samples;

- Inductively Coupled Plasma (ICP) Interference Check Standards after initial calibration, and after samples are analyzed;

- An ICP Serial Dilution Analysis for every 20 samples of a similar matrix;

- A graphite furnace atomic absorption (GFAA) post-digestion spike for every 20 samples of a similar matrix; and

- Control limits determined by the laboratories (these are listed in Tables FA1-2 and FA1-3 in Attachment F1 to this QAPP).

For a description of the routine laboratory QC requirements and the frequency of audit, refer to the submitted SOPs. Modifications to the routine laboratory QC requirements are not needed to meet the project-specific objectives of the SCS. The control limits for the method/preparation blanks, matrix spikes, matrix spike duplicates, laboratory control samples, and surrogate spikes are listed in Tables FA1-2 and FA1-3 in Attachment F1 to this QAPP. Additional QC criteria (internal standard areas, degradation checks, ICP interference checks, for example) are included throughout the analytical SOPs, provided as Attachments F2 – F11 to this QAPP.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria that are not attributable to sample matrix interferences will be reanalyzed by the laboratory, if sufficient

volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis, when necessary.

SECTION 9

DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by laboratory operations shall be reduced and validated prior to reporting. No data shall be disseminated by the laboratory until it has been subjected to these procedures which are summarized in subsections below:

9.1 Data Reduction

Data reduction involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements, and calculations.

Data reduction occurs with

- The work plan through sample locations and naming conventions,
- The field sampling process through use of field logs and field measurements,
- Field communications with the laboratory in sample analysis requests,
- Field operations with collection, preservation, and Chain-of-Custody documentation,
- Laboratory operations with sample receipt and handling, sample preparation and analysis, collation of raw data, and generation of laboratory results, and
- Post-laboratory operations with collation of analytical results in a format suitable for documents such as reports, maps, and trend plots.

Data reduction steps include field operations, laboratory operations, and report preparation operations.

Specific QC measures developed to ensure accuracy throughout the data reduction process are described in Sections 10 and 12.

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct read instrumentation will be employed in the field. The use of pH meters, thermometers, a dissolved oxygen meter, a probe to measure specific conductance, a stream flow meter, and a water level recorder will generate some measurements directly read from the instrument/meters following calibration per manufacturer's recommendations as outlined in Section 6 of this QAPP. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results forms required for this study are being filled out, the WCIA Field Team Leader, identified in Section 2.6.1 of this QAPP, will proof the forms to determine whether any transcription errors have been made by the field crew.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the following protocol. All raw analytical data will be recorded in each laboratory's Laboratory Information Management Systems (LIMS) and tabular summary tables will be generated. Data are recorded in each laboratory's LIMS, along with other pertinent information, such as the sample identification number, the analytical method used, the name of the analyst, the date of analysis, and matrix sampled. At a minimum, reagent concentrations, instrument settings, and raw data are retained by hard copy and laboratory notebooks, which shall be signed and dated by the analyst. Copies of any strip chart printouts (such as gas chromatograms) will be maintained on file. Periodic review of raw data and of the computerized records by the laboratory Quality Assurance Officer takes place prior to final data reporting.

For this project, the equations that will be employed in reducing data are presented in the laboratory SOPs, which have been included in Attachments F2 - F11 to this QAPP. (In addition, two of these equations, expressing analytical accuracy and precision, have been presented in Section 12 of this QAPP.) Such formulae make pertinent allowance for matrix type. All calculations will be checked by the laboratory technical staff. Errors will be noted, and corrections will be made. The original notations will be crossed out legibly. Analytical results for sediment samples shall be calculated and reported on a dry-weight basis.

Quality control data (e.g., laboratory duplicates, surrogates, matrix spikes, and matrix spike duplicates) will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the laboratory Quality Assurance Officer for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the laboratory Quality Assurance Officer approves these data, they are considered ready for third-party data validation.

9.2 Data Validation

Data validation is the process of verifying that qualitative and quantitative information generated relative to a given sample is complete and accurate. Data validation procedures shall be performed for both field and laboratory operations as described below:

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors on the part of the field crew members and review of field log books. These procedures are performed to ensure that field measurements and various quality control analyses were properly performed and documented. The field data documented includes those generated during measurement of field parameters, observations, results of any quality control sample analyses, and field instrument calibrations. This task will be the responsibility of the WCIA Field Team Leader, who will otherwise not participate in making any of the field measurements or in adding notes, data or other information to the log book.

9.2.2 Procedures to Validate Laboratory Data

All of the analytical data generated by the project laboratories during the SCS, with the exception of data generated from the analysis of archived samples, will undergo an independent data review by trained reviewers independent to the laboratory under the direction of the Environmental Standards Data Validation Task Manager. (The role of the Environmental Standards Data Validation Task Manager is indicated in the Project Organization [Section 2.3.4] of this QAPP.) The validation of the laboratory data will be performed with guidance from the "*US EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review*," (February 1994) and the "*US EPA*

Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," (February 1994). These documents provide most of the criteria by which data are accepted or rejected and were used as a basis in developing the data validation SOPs listed in Table F9-1. These data validation SOPs have been provided in Attachment F14 to this QAPP and will provide the specific criteria used to validate the data for each analytical parameter for the SCS.

Analytical data from critical analysis fractions (BTEX, PAHs, phenols, organochlorine pesticides, PCBs, organochlorine herbicide 2,4-D, metals, total cyanide, AVS, and SEM) will undergo a full validation process. Full validation will include an evaluation of all documented QA/QC measures through a review of all tabulated QC summary forms and all raw instrument data. A percentage (20%) of analytical data from non-critical analysis fractions (all wet chemistry except total cyanide and AVS) will also undergo the full validation process. All data that are not validated in full will undergo a limited validation process. Limited validation will include an evaluation of a limited number of QA/QC measures (holding times, blank contamination including method, trip, and equipment blanks, precision and accuracy based on the results of the LCS and MS/MSD, and field duplicate precision and sample representativeness) through a review of tabulated QC summary forms applicable to those measures. Limited validation will not include an evaluation of any raw instrument data.

A preliminary review will be performed to verify that all necessary paperwork (Chain-of-Custody records, analytical reports, laboratory personnel signatures) and deliverables (as specified in the SCS Work Plan and QAPP) for the analyses are present. At a minimum, deliverables will include sample Chain-of-Custody records, a detailed case narrative, analytical results, calibration summaries, QC summaries, and supporting raw data from instrument printouts as specified in Section 9.3.2 of this QAPP. The Data Validation Task Manager will contact a project laboratory to request the correction of certain deficiencies prior to the submittal of the Quality Assurance Review, if such corrections are necessary for a full evaluation of the usability of the data. Such correctable deficiencies may include missing data deliverables or calculation errors that would take a significant amount of the staff reviewer's time to correct. In addition, the Data Validation Task Manager may contact a project laboratory to request the correction of all correctable deficiencies prior to the submittal of the Quality Assurance Review, if time allows. Any laboratory resubmittals as a result of such requests will be discussed in the appropriate "Comments" section of the Quality Assurance Review.

A detailed review will be performed by the Environmental Standards Data Validation Task Manager or staff reviewer of Environmental Standards to independently verify compliance to the required analytical protocols and to determine the qualitative and quantitative reliability of the data as they are presented. Full validation will include a detailed review and interpretation of all data generated by the laboratory. Limited validation will include a detailed review and interpretation of the tabulated QC summary forms which are applicable to the required QA/QC measures. The primary tools which will be used by experienced data review chemists are to be guidance documents, established (contractual) criteria, the data validation SOPS provided in Attachment F14 to the QAPP, and professional judgment.

Based upon the review of the analytical data, a Quality Assurance Review will be prepared which will summarize the qualitative and quantitative reliability of the analytical data. During the course of the data review, a full organic, inorganic, and general chemistry support documentation package will be prepared from the deliverables provided by the laboratory which will provide backup information that will accompany all qualifying statements presented in the quality assurance review. Table F9-2) provides a summary of the Quality Assurance Review report format, including the support documentation packages.

Based upon the quality assurance review of the analytical data, the following qualifier codes will be placed next to specific sample results on sample result summaries (included in Section 2 of the Quality Assurance Review as noted in Table F9-2). These defined qualifier codes will serve as an indication of the qualitative and quantitative reliability.

The data qualifier codes and definitions will be as follows:

U - This compound/analyte should be considered "not detected" since it was detected in a blank at a similar level.

J - Quantitation is approximate due to limitations identified during the quality assurance review (data validation).

N - The analysis indicates that there is presumptive evidence to make a "tentative identification" of this compound/analyte.

R - Unusable result – compound/analyte may or may not be present in this sample.

UJ - This compound/analyte was not detected, but the quantitation/detection limit is probably higher due to a low bias identified during the quality assurance review.

Once the review has been completed, the Environmental Standards Data Validation Task Manager will submit the report and data tables to the DuPont CRG Project Manager. The approved quality assurance review will be signed and dated by the Environmental Standards Data Validation Task Manager.

9.3 Data Reporting

Data reporting procedures shall be carried out for field and laboratory operations as indicated below:

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and log book notes made in the field.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data (to the US EPA) begins after the internal laboratory validation activity has been concluded. The laboratory Quality Assurance Officer must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. One complete "CLP-like" data package (for all samples) will be delivered to the DuPont CRG Project Manager, and will be made available to the US EPA Region 5 upon request. In addition to the record of Chain-of-Custody, the report format shall consist of the items identified in Table F9-3. Examples of the forms that will be used by Lancaster Laboratories to tabulate the information have been provided in Attachment F15.

TABLE F9-1 DATA VALIDATION SOPS FOR ORGANIC, INORGANIC AND WET CHEMISTRY PARAMETERS

SOP NUMBER	SOP FOR DATA VALIDATION	PARAMETER(S)/PARAMETER GROUP	ANALYTICAL METHOD
DV-GEN-01	General Validation Procedures and Qualifier Codes	General Procedures for all Parameters	NA
DV-GEN-02	Preparation of Written Quality Assurance Reviews to Report Data Validation Results	General Procedures for all Parameters	NA
DV-VOA-01	Validation of Volatile Organic Compound Results Generated by SW-846 Method 8260B	BTEX	SW-846 8260B
DV-BNA-01	Validation of Semivolatile Organic Compound Results Generated by SW-846 Method 8270C	PAHs and Phenols	SW-846 8270C
DV-OCPP-01	Validation of Organochlorine Pesticide/PCB Compound Results Generated by SW-846 Methods 8081A and 8082	Pesticides and PCBs	SW-846 8081A/8082
DV-OCH-01	Validation of Organochlorine Herbicide Compound Results Generated by SW-846 Method 8151A	2,4-D	SW-846 8151A
DV-MET-01	Validation of Metals Data Generated by SW-846 6010B	Metals except Mercury by ICP	SW-846 6010B
DV-MET-02	Validation of Metals Data Generated by SW-846 7000A	Arsenic and Lead by GFAA	SW-846 7000 series
DV-MET-03	Validation of Metals Data Generated by SW-846 7470A/7471A	Mercury and Simultaneously Extracted Mercury	SW-846 7470A/7471A
DV-MET-01	Validation of Metals Data Generated by SW-846 6010B	Simultaneously Extracted Metals Except Mercury	SW-846 6010B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Acid Volatile Sulfides	SW-846 9030B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Cyanide	SW-846 9012A
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Oil & Grease	SW-846 9071A
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Phenolics	SW-846 9065
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Soluble Fluoride, Soluble Sulfate, Nitrate/Nitrite Nitrogen	SW-846 9056
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Sulfide	SW-846 9030B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Ammonia Nitrogen	EPA 350.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Kjeldahl Nitrogen	EPA 351.2
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Phosphorus	EPA 365.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	pH	SW-846 9045C
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Organic Carbon (Soluble)	EPA 415.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Solids	EPA 160.3
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Grain Size	ASTM D422-63
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Fecal Coliform Bacteria	SM 9221C
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Chemical Oxygen Demand	EPA 410.4
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Biochemical Oxygen Demand	EPA 405.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Orthophosphate	EPA 365.3
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Suspended Solids	EPA 160.2
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Hardness	EPA 130.2

NOTES:

BTEX - Benzene, Toluene, Ethylbenzene, Xylenes (Total)

TCL - Target Compound List

NA - Not Applicable

ICP - Inductively Couple Plasma

GFAA - Graphite Furnace Atomic Absorption

TABLE F9-2
FORMAT OF ENVIRONMENTAL STANDARDS' QUALITY ASSURANCE REVIEW

TITLE PAGE
TABLE OF CONTENTS
EXECUTIVE SUMMARY
INTRODUCTION AND SAMPLE LISTING

SECTION 1

1. Introduction

The introduction section will briefly state the amount of samples analyzed, who analyzed them, what parameters were analyzed for, and by what methods.

2. Laboratory Compliance

This section will specify any correctable and/or noncorrectable deficiencies and informative comments that were identified relative to the organic, inorganic, and general chemistry requirements specified in the analytical SOPs. Appropriate EPA citations or project citations will be provided for each item listed. This section will also specify discrepancies between the reported data and the raw data.

3. Data Qualifiers

This section will present qualifiers that should be considered in order for the data to best be utilized, including a detailed assessment of the degree to which data have been compromised by any deviation from protocol (i.e., lack of analytical control and QC failure). For every statement made in this section, there is a subsequent finding that justifies the qualifying statement. These qualifiers/findings are presented as bulleted items in order of importance relative to their impact on the data set. The data qualifiers will be presented in two subsections; organic data and inorganic and general chemistry data. Within each subsection the qualifiers will be presented in the order of greatest impact to least impact.

SECTION 2

This section will include the qualified sample result summaries, including a glossary defining the qualifier codes. These qualified spreadsheets will be presented in the order of BTEX, PAHs/phenols, pesticides, PCBs, herbicides, metals, and general chemistry parameters.

SECTION 3

The organic quality assurance review is fully supported by a documentation appendix. For every qualifier made in the report, there is a photocopied page of laboratory data that is used in support of the reviewer's comments. All QC summary forms as well as the reviewer's worksheets are presented in the support documentation.

SECTION 4

The inorganic and general chemistry quality assurance review is also fully supported by a documentation appendix in the same format as the organic data. All QC summary forms as well as the reviewer's worksheets are presented in the support documentation.

SECTION 5

This section of the quality assurance review will contain the laboratory case narratives and the field and laboratory Chains-of-Custody Records.

SECTION 6

This section of the quality assurance review will any applicable project correspondence.

TABLE F9-3
LABORATORY DATA PACKAGE DELIVERABLES

1. Case Narrative:

   i. Date of issuance
   ii. Laboratory analysis performed
   iii. Any deviations from intended analytical strategy
   iv. Laboratory batch number
   v. Numbers of samples and respective matrices
   vi. Quality control procedures utilized and also references to the acceptance criteria
   vii. Laboratory report contents
   viii. Project name and number
   ix. Condition of samples 'as-received'
   x. Discussion of whether or not sample holding times were met
   xi. Discussion of technical problems or other observations which may have created analytical difficulties
   xii. Discussion of any laboratory quality control checks which failed to meet project criteria
   xiii. Signature of the laboratory Quality Assurance Officer

2. Chemistry Data Package

   i. Case narrative for each analyzed batch of samples
   ii. Summary page indicating dates of analyses for samples and laboratory quality control checks
   iii. Cross-referencing of laboratory sample to project sample identification numbers
   iv. Data qualifiers to be used should be adequately described
   v. Sample preparation and analyses logs for samples
   vi. Sample results
   vii. Raw data for sample results and laboratory quality control samples
   viii. Results of (dated) initial and continuing calibrations checks, GC/MS tuning results, and analyte breakdown checks
   ix. Matrix spike and matrix spike duplicate recoveries, laboratory control samples, method blank results, surrogate compound results, and internal standard results
   x. Labeled (and dated) chromatograms/spectra of sample results and laboratory quality control checks
   xi. Results of ICP interference checks, post-digestion spikes, and serial dilution analyses
   xii. ICP instrument detection limits, linear ranges, and interelement correction factors

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

10.1 Field Performance and System Audits

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the WCD Project Manager.

10.1.1.2 Internal Field Audit Frequency

These audits will verify that all established procedures are being followed. An internal field audit will be conducted at least once at the beginning of each site sample collection activity (surface sediment sampling, shallow core sampling, deep core sampling, wetlands sediment sampling, and surface water sampling).

10.1.1.3 Internal Field Audit Procedures

The audit will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, Chain-of-Custody, etc. Follow-up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the SCS. The audit will involve review of field measurement records, instrumentation calibration records, and sample documentation. The field audit checklist to be used for this project is submitted as Attachment F16 to this QAPP.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

External field audits may be conducted by the US EPA Region 5 Project Coordinator.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the US EPA.

10.1.2.3 Overview of the External Field Audit Process

External field audits will be conducted according to the field activity information defined in the QAPP and FSP.

10.2 Laboratory Performance and Systems Audits

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Laboratory Audit Responsibilities

Internal laboratory audits will be conducted by each laboratory's QA Officer or designate.

10.2.1.2 Internal Laboratory Audit Frequency

Lancaster Laboratories performs internal laboratory system audits twice per year. NET performs internal system audits on a monthly basis in the various laboratory departments including, but not limited to, bacteriology, wet chemistry, reporting, customer service, and administration. With regard to laboratory performance audits, both laboratories participate in various performance evaluation (PE) audit programs including, but not limited to, internal programs, US EPA water pollution (WP) PEs, and US EPA Water

Supply (WS) PEs. Each of these programs are conducted at various frequencies (generally annually or semi-annually) throughout the year.

10.2.1.3 Internal Laboratory Audit Procedures

The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, Chain-of-Custody procedures, sample preparation and analysis, instrument operating records, etc. Each laboratory's QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. The Lancaster Laboratories and NET laboratory audit checklists have been included as Attachments F17 and F18, respectively.

10.2.2 External Laboratory Audits

10.2.2.1 External Laboratory Audit Responsibilities

An external audit may be conducted by US EPA RCRA Enforcement and Compliance Branch.

10.2.2.2 External Laboratory Audit Frequency

An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the US EPA.

10.2.2.3 Overview of the External Laboratory Audit Process

External laboratory audits may include (but may not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

SECTION 11

PREVENTATIVE MAINTENANCE

Preventative maintenance of laboratory and field equipment is essential to obtaining accurate data. Unnecessary resampling and analysis can be avoided if equipment is well maintained.

11.1 Field Instrument Preventative Maintenance

The field equipment for this project includes thermometers, pH meters, conductivity meters, dissolved oxygen meters, a stream flow meter, and a water elevation recorder. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. The details of all preventative maintenance will be recorded in the Field Logbook each time that it is performed. Critical spare parts such as tape, pH probes, and batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule. Field equipment routine daily maintenance will include, but is not limited to:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems;
- Decontamination of the sampling equipment and measurement systems before and after use;
- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries);
- Checking instrument calibrations as described in Section 6.1 of this QAPP; and
- Charging any battery packs for equipment when not in use.

11.2 Laboratory Instrument Preventative Maintenance

As part of their QA/QC program, a routine preventative maintenance program is conducted by each project laboratory to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees shall regularly perform routine scheduled maintenance and repair of (or to coordinate with the vendor for the repair of) all instruments. Every time any maintenance is performed, it is documented in the laboratory's applicable maintenance record books. The record of maintenance includes, at a minimum, actions taken,

parts replaced, analysts' initials, and the date the maintenance was performed, whether by the analyst or a contracted service representative. Laboratory instruments are maintained in accordance with manufacturer's specification. Table F11-1 provides the frequency which components of key analytical instruments or equipment will be serviced. The laboratories will maintain a complete inventory of replacement parts needed for preventative maintenance and spare parts that routinely need replacement (e.g., septa, gauges, sources, and detectors). If an instrument fails, the problem will be diagnosed as quickly as possible, and either replacement parts will be ordered or a service call will be place to the manufacturer.

Table F11-1

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS	Change septum	Weekly or AN*
	Check fans	Monthly
	Check cool flow	Monthly
	Clean source	Bimonthly or AN
	Change oil in vacuum pump	Semiannually
	Change oil in turbo pump	Semiannually
GC	Septum change	Each run
	Column maintenance	AN
	Clean detector	AN
	Vacuum filters	Semiannually
	Leak check ECDs	Semiannually
GFAA	Rinse workhead assembly	Weekly
	Clean windows	Weekly
	Replace probe tubing	AN
	Check rinse bottle & drain	Daily
Cold Vapor AA	Change drying tube	Daily
	Replace pump tubing	AN: Min. weekly
	Lubricate pump head	Weekly
	Lubricate autosampler	Weekly
	Inspect optical cell and windows	Monthly
	Clean	AN
ICP	Clean torch	AN
	Clean nebulizer & spray chamber	AN
	Replace pump winding	Check Daily
	Lubricate autosampler	Check Daily
	Check mirror	Daily
	Checking tubing to torch	Daily
	Check fan filters, clean if needed	Weekly
	Check cool flow, clean if needed	Weekly
	Check water filter, replace if needed	Quarterly

Table F11-1

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
Autoanalyzer	Clean sample probe	AN
	Clean proportioning pump	Weekly
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	Monthly
	Inspect condition of distillation head	Monthly
Total Organic Carbon Analyzer	Check IR zero	AN
	Check for leaks	AN
	Check acid pump calib.	Bimonthly
	Check persulfate pump calibration	Bimonthly
	Inspect 6-port rotary valve	AN
	Inspect sample pump head	AN
	Wash molecular sieve	AN
	Check sample loop calibration	Monthly
	Clean gas permeation tube	AN
	Inspect digestion vessel O-rings	AN
	Check activated carbon scrubber	AN
	Dust back and clean circuit boards	AN
	Check IR cell	AN

* AN means as needed. Any of these items may be performed more frequently if response during operation indicates this is necessary.

SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

12.1 Accuracy Assessment

Accuracy is defined as the nearness of a result or the mean of a set of results to the true value. In order to assure proper accuracy of the analytical procedures, environmental samples will be designated for the laboratory to spike with a known amount of the analyte or analytes to be evaluated. In general, a sample spike should be included in every set of 20 samples of the same matrix. The spike sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte and compared to the reported value of the same analyte in the unspiked sample, determines the percent recovery. The laboratory then compares the percent recoveries to the control limits, which are listed in Attachment F1, Table FA1-3, of this QAPP. The analyst is responsible for this comparison and applies appropriate corrective action as needed. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%\text{Recovered} = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample})}{\text{Known Amount Added}} \times 100\% \qquad \text{(Eq. 1)}$$

In addition to a spiking program, samples, standards, and blanks subject to organic analyses will be spiked with surrogate compounds. Laboratory performance on individual samples will be established by the recovery of surrogate compounds.

12.2 Precision Assessment

Precision is defined as the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses. Spiked samples are prepared at the laboratory from designated samples, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. For some analyses, duplicate samples are prepared at the laboratory from designated samples by just dividing the sample into equal aliquots. The duplicate spiked samples and/or the duplicate samples are then included in the analytical sample set. This allows the analyst to determine the precision of the preparation

and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the duplicate spiked samples and/or the duplicate samples are calculated. The laboratory then compares the RPDs to the control limits, which are listed in Attachment F1, Table FA1-3, of this QAPP. The analyst is responsible for this comparison and applies appropriate corrective action as needed. The RPD is calculated according to the following formula:

$$RPD = \frac{|D_2 - D_1|}{0.5\,(D_1 + D_2)} \times 100\%$$

where: D_1 is defined as the first subsample value (or % recovery for spiked sample)
D_2 is defined as the second subsample value (or % recovery for spiked sample)

(Eq. 2)

Precision may also be assessed by calculating the relative standards deviation (RSD) for three or more measurements. RSD is calculated according to the following formula:

$$RSD = \frac{\sqrt{\left(\sum_{I=1}^{n} \frac{(x_i - x)^2}{n-1}\right)}}{x}$$

where: x_i = each observed value
x = the arithmetic mean of all observed values
n = total number of values

(Eq. 3)

In addition to evaluation of the method precision, duplicate samples will be collected in the field and analyzed independently. The results will be used to evaluate the total system's variability, including sampling variations. The analytical precision produced by laboratory replicate analyses will be evaluated by both the laboratory and Environmental Standards, while field duplicate will be evaluated only by Environmental Standards. Evaluation of both types of data will be in accordance with the references methods in this QAPP.

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing and the independent data review, the percent completeness will be calculated by the following equation:

$$\% \text{ Completeness} = \frac{\text{Usable, Critical Data Obtained}}{\text{Total Critical Data Planned to be Obtained}} \times 100\% \qquad \text{(Eq. 4)}$$

where: Usable, Critical Data is defined as all critical data results that are not rejected in the data validation process.
Total Critical Data Planned to be Obtained is defined as all critical data that is possible based on the number of samples planned to be collected for analysis.

The percent completeness will be used to determine whether the data quality meets the objectives for the project.

SECTION 13

CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or poor QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the WCD Project Manager, or his designee. If immediate corrective action is required, approvals secured by telephone from the WCD Project Manager should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the WCD Project Manager, who in turn will notify the US EPA RCRA Project Coordinator. If the problem is analytical in nature, information on these problems will be promptly communicated to the US EPA Region 5. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. The WCD Project Manager, or his designee, will issue a nonconformance report for each nonconformance condition.

13.1 Field Corrective Action

Corrective action in the field can be needed when the sample network is changed (i.e. more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. In general, the field team (technician, WCIA Field Team Leader, WCD Project Manager, DuPont CRG QA Manager, and DuPont CRG Project QA Manager) may identify the need for corrective action. The field staff in consultation with the WCIA Field Team Leader will recommend a corrective action. The WCD Project Manager will approve the corrective measure which will be implemented by the field team. It will be the responsibility of the WCIA Field Team Leader to ensure the corrective action has been implemented.

If the corrective action will supplement the existing sampling plan (i.e. additional sediment core samples) using existing and approved procedures in the QAPP, corrective action approved by the WCIA Field Team Leader will be documented. If corrective actions resulting in fewer samples (or analytical fractions), alternate locations, etc. keep project quality assurance objectives from being achieved, it will be necessary that all levels of project management, including the SCS DuPont CRG Project Coordinator and the US EPA RCRA Project Coordinator, concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The DuPont CRG Project QA Manager will identify deficiencies and recommended corrective action to the WCD Project Manager. Implementation of corrective actions will be performed by the WCIA Field Team Leader and field team. Corrective action will be documented in quality assurance reports to the entire project management team.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the US EPA RCRA Project Coordinator.

13.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during and after initial analyses. Each laboratory's corrective action procedures are provided throughout the SOPs provided in Attachments F2 - F11. The submitted SOPs specify the majority of the conditions during or after analysis that automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, or automatic reinjection/reanalysis when certain QC criteria are not met. Furthermore, a number of conditions, such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples, may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts, it may be necessary for the laboratory QA Officer to approve the implementation of corrective action.

A member of the laboratory technical staff will identify the need for corrective action. The laboratory QA Officer, in consultation with members of the technical staff, will approve the required corrective action to be implemented by designated members of the laboratory technical staff. The laboratory QA Officer will also ensure implementation and documentation

of the corrective action. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform all levels of project management, including the US EPA RCRA Project Coordinator, to concur with the corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented on a laboratory corrective action log, and the narrative data report sent from the laboratory to the Environmental Standards data validator. If corrective action does not rectify the situation, the laboratory Project Manager will contact the DuPont CRG Project QA Manager.

13.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

As previously stated in Section 12.3, the percent completeness will be used to determine whether the data quality meets the objectives for the project. If the completeness objectives are not met for individual parameters, the reasons for the invalid data will be reviewed by DuPont. Depending on the ability to mobilize the field team, the reasons for the incomplete data (e.g., holding time exceeded), and the effect of the incomplete data on the accomplishment of the project objectives, additional samples may be collected and analyzed. An evaluation will also be conducted if a sample does not generate data for a parameter category (e.g., volatile organic constituents, metals). Such a data gap could result from sample container breakage or loss of or sample custody not being maintained. If DuPont determines that the missing results are critical to accomplishing the work plan objectives, additional sampling will be conducted to obtain the missing data. The WCD Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the DuPont CRG Project QA Manager.

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The deliverables associated with the tasks identified in the SCS Workplan and bimonthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. These reports will be the responsibility of the SCS DuPont CRG Project Coordinator and will include the DuPont CRG Project QA Manager report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project. The Environmental Standards Data Validation Task Manager will provide the DuPont CRG Project QA Manager with the accuracy and precision assessment for this purpose.

14.1 Contents of Project QA Reports

The QA reports will contain, on a routine basis, all results of any field and laboratory audits performed during the past two months, all information generated during the past two months reflecting on the achievement of specific DQOs (including data validation and assessment results), and a summary of corrective action that was implemented and its immediate results on the project. The status of analytical and data validation tasks will be summarized for the project with respect to the Project Schedule included in Figure 5-3 of the SCS Work Plan. Based on this information, the QA reports will also include an indication of whether the QA objectives were met and limitations on the reported data. In addition, whenever necessary, updates on training provided, changes in key personnel, and anticipated problems in the field or laboratory for the coming two months that could bear on data quality along with proposed solutions will be reported. Furthermore, detailed references to QAPP modifications will also be highlighted. All QA reports will be prepared in written, final format by the SCS DuPont CRG Project Coordinator or his designee.

14.2 Frequency of QA Reports

The QA Reports will be prepared on a bimonthly basis and will be delivered to all recipients by the 10th of every other month. The reports will continue without interruption until the project has been completed. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. These events and their resolution will be addressed thoroughly in the next issue of the bimonthly QA report.

14.3 Individuals Receiving/Reviewing QA Reports

Those individuals identified in the List of QAPP recipients will receive copies of the bimonthly QA report. The QA Reports will be submitted to the US EPA Region 5 and IDEM with the bimonthly progress reports discussed in Section 5.5.1 of the SCS Work Plan.

ATTACHMENT F1

DATA QUALITY OBJECTIVES

TABLE FA1-1: DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

DQO Parameter	Aqueous Criteria	Sediment/Solid Criteria
Precision	Table FA1-2 and Table FA1-3	Table FA1-2 and Table FA1-3
Accuracy	Tables FA1-2, FA1-3, and FA1-4	Tables FA1-2, FA1-3, and FA1-4
Sensitivity	Table F1-2	Table F1-1
Representativeness (Field Duplicates)	The RPD between the results of aqueous field duplicates should be less than or equal to 20% for results greater than 5 X the PQL. The difference between results in aqueous field duplicates should be less than the PQL when at least one result is less than or equal to 5X the PQL.	The RPD between the results of sediment/solid field duplicates should be less than or equal to 40% for results greater than 5 X the PQL. The difference between results in sediment/solid field duplicates should be less than 2X the PQL when at least one result is less than or equal to 5X the PQL.
Completeness	90% for field data 95% for laboratory data	90% for field data 95% for laboratory data
Comparability	Based on Precision and Accuracy and Media Comparison	Based on Precision and Accuracy and Media Comparison

NOTES: DQO = Data Quality Objective. RPD = Relative Percent Difference. PQL = Practical Quantitation Limit.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
BTEX	Lab blank, trip blank, or equipment blank	All BTEX Compounds	< the PQL for all BTEX Compounds	< the PQL for all BTEX Compounds
	Matrix Spike Duplicate Precision	All BTEX Compounds	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All BTEX Compounds	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All BTEX Compounds	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	4-Bromoflurobenzene	86-115%	74-121%
		1,2-Dichloroethane-d_4	80-120%	80-120%
		Toluene-d_8	88-110%	81-117%
		Dibromofluoromethane	86-118%	80-120%
PAHs and Phenols	Lab blank or equipment blank	All PAHs and Phenols	< the PQL for all PAHs and Phenols	< the PQL for all PAHs and Phenols
	Matrix Spike Duplicate Precision	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	Nitrobenzene-d_5	47-114%	31-126%
		2-Fluorobiphenyl	51-106%	45-113%
		p-Terphenyl-d_{14}	37-119%	37-130%
		Phenol-d_6	7-74%	39-108%
		2-Fluorophenol	25-88%	35-108%
		2,4,6-Tribromophenol	34-125%	23-125%

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
Pesticides Compounds	Lab blank or equipment blank	All Pesticides	<PQL for all pesticides	<PQL for all pesticides
	Matrix Spike Duplicate Precision	All Pesticides	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Pesticides	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Pesticides	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	tetrachloro-*meta*-xylene decachlorobiphenyl	60-120% 60-120%	50-120% 50-120%
PCBs	Lab blank or equipment blank	All PCBs	<PQL for PCBs	<PQL for PCBs
	Matrix Spike Duplicate Precision	All PCBs	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All PCBs	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All PCBs	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	tetrachloro-*meta*-xylene decachlorobiphenyl	60-120% 60-120%	50-120% 50-120%

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
Organochorine Herbicide	Lab blank or equipment blank	2,4-D	<PQL for 2,4-D	<PQL for 2,4-D
	Matrix Spike Duplicate Precision	2,4-D	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	2,4-D	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	2,4-D	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	DCAA	60-120%	50-120%
Metals and Simultaneously Extracted Metals (SEM)	Lab blank or equipment blank	All Metals	<PQL for all metals	<PQL for all metals
	Laboratory Duplicate Precision	All Metals	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Metals	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Metals	Table FA1-3	Table FA1-3
All Wet Chemistry Parameters	Lab blank or equipment blank	All Parameters	<PQL for all parameters	<PQL for all parameters
	Laboratory Duplicate Precision	All Parameters	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Parameters	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Parameters	Table FA1-3	Table FA1-3

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
BTEX								
71-43-2	Benzene	SW-846 8260B	NA	NA	82-123	76-128	30	77-126
100-41-4	Ethylbenzene	SW-846 8260B	NA	NA	89-124	77-138	30	86-129
108-88-3	Toluene	SW-846 8260B	NA	NA	80-126	69-140	30	74-128
1330-20-7	Xylenes (total)	SW-846 8260B	NA	NA	89-123	83-135	30	88-128
Polycyclic Aromatic Hydrocarbons (PAHs) and Phenols								
83-32-9	Acenaphthene	SW-846 8270C	NA	NA	61-100	47-114	30	61-100
208-96-8	Acenaphthylene	SW-846 8270C	NA	NA	64-100	42-119	30	62-101
120-12-7	Anthracene	SW-846 8270C	NA	NA	66-101	42-119	30	62-105
56-55-3	Benzo[a]anthracene	SW-846 8270C	NA	NA	69-101	33-135	30	63-106
205-99-2	Benzo[b]fluoranthene	SW-846 8270C	NA	NA	64-101	24-148	30	59-105
207-08-9	Benzo[k]fluoranthene	SW-846 8270C	NA	NA	67-105	41-126	30	63-108
191-24-2	Benzo[ghi]perylene	SW-846 8270C	NA	NA	55-115	12-133	30	52-113
50-32-8	Benzo[a]pyrene	SW-846 8270C	NA	NA	65-101	21-139	30	61-107
59-50-7	4-Chloro-3-methylphenol	SW-846 8270C	NA	NA	60-111	22-142	30	56-108
95-57-8	2-Chlorophenol	SW-846 8270C	NA	NA	62-107	36-124	30	55-107
218-01-9	Chrysene	SW-846 8270C	NA	NA	67-101	9-153	30	60-107
132-64-9	Dibenzofuran	SW-846 8270C	NA	NA	67-99	38-120	30	62-102
53-70-3	Dibenz[a,h]anthracene	SW-846 8270C	NA	NA	66-117	11-152	30	60-117
120-83-2	2,4-Dichlorophenol	SW-846 8270C	NA	NA	65-98	39-135	30	59-100
105-67-9	2,4-Dimethylphenol	SW-846 8270C	NA	NA	52-99	32-119	30	39-108
534-52-1	4,6-Dinitro-2-methylphenol	SW-846 8270C	NA	NA	43-120	5-128	30	42-107
51-28-5	2,4-Dinitrophenol	SW-846 8270C	NA	NA	25-124	1-126	30	29-117
206-44-0	Fluoranthene	SW-846 8270C	NA	NA	66-106	26-137	30	58-110
86-73-7	Fluorene	SW-846 8270C	NA	NA	61-108	59-121	30	59-109
193-39-5	Indeno[1,2,3-cd]pyrene	SW-846 8270C	NA	NA	59-111	28-127	30	55-111
78-59-1	Isophorone	SW-846 8270C	NA	NA	66-113	46-127	30	57-114
91-57-6	2-Methylnaphthalene	SW-846 8270C	NA	NA	62-98	45-112	30	60-102
95-48-7	2-Methylphenol	SW-846 8270C	NA	NA	55-96	20-130	30	37-101
65794969	3 or 4-Methylphenol	SW-846 8270C	NA	NA	48-99	22-138	30	48-116
91-20-3	Naphthalene	SW-846 8270C	NA	NA	60-97	50-106	30	58-99
88-75-5	2-Nitrophenol	SW-846 8270C	NA	NA	67-104	40-125	30	59-107
100-02-7	4-Nitrophenol	SW-846 8270C	NA	NA	Mar-83	5-132	30	44-110
87-86-5	Pentachlorophenol	SW-846 8270C	NA	NA	46-114	14-131	30	42-108
85-01-8	Phenanthrene	SW-846 8270C	NA	NA	68-102	54-120	30	62-107
108-95-2	Phenol	SW-846 8270C	NA	NA	30437	29-112	30	49-105
129-00-0	Pyrene	SW-846 8270C	NA	NA	58-112	52-115	30	52-115
95-95-4	2,4,5-Trichlorophenol	SW-846 8270C	NA	NA	67-103	18-139	30	63-107
88-06-2	2,4,6-Trichlorophenol	SW-846 8270C	NA	NA	66-105	37-127	30	62-106

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Organochlorine Pesticides								
309-00-2	Aldrin	SW-846 8081A	NA	NA	41-115	49-145	50	49-145
319-84-6	alpha-BHC	SW-846 8081A	NA	NA	60-133	48-144	50	48-144
319-85-7	*beta*-BHC	SW-846 8081A	NA	NA	64-122	34-145	50	34-145
319-86-8	*delta*-BHC	SW-846 8081A	NA	NA	64-132	51-142	50	44-145
58-89-9	*gamma*-BHC/Lindane	SW-846 8081A	NA	NA	62-132	51-142	50	51-142
72-54-8	4,4'-DDD	SW-846 8081A	NA	NA	60-134	53-141	50	53-141
72-55-9	4,4'-DDE	SW-846 8081A	NA	NA	55-126	61-135	50	61-135
50-29-3	4,4'-DDT	SW-846 8081A	NA	NA	59-135	60-138	50	60-138
60-57-1	Dieldrin	SW-846 8081A	NA	NA	61-122	59-130	50	59-130
959-98-8	Endosulfan I	SW-846 8081A	NA	NA	45-132	46-135	50	46-135
33213-65-9	Endosulfan II	SW-846 8081A	NA	NA	52-130	48-132	50	48-132
1031-07-8	Endosulfan sulfate	SW-846 8081A	NA	NA	67-132	40-150	50	40-150
72-20-8	Endrin	SW-846 8081A	NA	NA	68-148	69-152	50	69-152
7421-93-4	Endrin aldehyde	SW-846 8081A	NA	NA	52-142	28-166	50	28-166
76-44-8	Heptachlor	SW-846 8081A	NA	NA	46-120	60-137	50	60-137
1024-57-3	Heptachlor epoxide	SW-846 8081A	NA	NA	64-126	59-136	50	59-136
72-43-5	Methoxychlor	SW-846 8081A	NA	NA	60-164	52-174	50	52-174
8001-35-2	Toxaphene	SW-846 8081A	NA	NA	NA	NA	NA	NA
5103-71-9	*alpha*-Chlordane	SW-846 8081A	NA	NA	67-124	70-134	50	70-134
5103-74-2	*gamma*-Chlordane	SW-846 8081A	NA	NA	63-114	65-125	50	65-125
53494-70-5	Endrin ketone	SW-846 8081A	NA	NA	69-121	53-135	50	53-135
PCBs								
12674-11-2	Aroclor-1016	SW-846 8082	NA	NA	43-126	64-127	50	64-127
11104-28-2	Aroclor-1221	SW-846 8082	NA	NA	NA	NA	NA	NA
11141-16-5	Aroclor-1232	SW-846 8082	NA	NA	NA	NA	NA	NA
53469-21-9	Aroclor-1242	SW-846 8082	NA	NA	NA	NA	NA	NA
12672-29-6	Aroclor-1248	SW-846 8082	NA	NA	NA	NA	NA	NA
11097-69-1	Aroclor-1254	SW-846 8082	NA	NA	NA	NA	NA	NA
11096-82-5	Aroclor-1260	SW-846 8082	NA	NA	51-126	69-123	50	69-123
Organochlorine Herbicide 2,4-D								
94-75-7	2,4-D	SW-846 8082	NA	NA	52-141	58-147	50	58-147

TABLE FA1-4: DATA QUALITY OBJECTIVES FOR FIELD PARAMETERS DUPONT - EAST CHICAGO, IN SCS QAPP

Field Parameter	Audit	Frequency	Control Limits
pH	Duplicate	Once per 20 samples or every day, whichever is more frequent.	±0.4 pH units
	Control Sample (different buffer than the initial calibration)	Once per 20 samples or every day, whichever is more frequent.	±0.2 pH units
Specific Conductivity	Blank	Once every day.	<5 µmhos/cm
	Duplicate	Once per 20 samples or every day, whichever is more frequent.	20% RPD
	Control Standard	Once every day.	90-110% Recovery
Dissolved Oxygen	Duplicate	Once per 20 samples or every day, whichever is more frequent.	20% RPD

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Wet Chemistry								
EVS-0162	Acid Volatile Sulfides	SW-846 9030B	NA	NA	80-120	75-125	20	80-120
57-12-7	Cyanide, Total	SW846 9012A	NA	NA	80-120	44-146	44	90-110
C-007	Oil & Grease	SW-846 9071A	64-122	25	66-104	45-148	20	88-108
C-020	Phenolics	SW-846 9065	53-126	19	73-115	41-139	23	70-116
16984-48-8	Soluble Fluoride	SW-846 9056	NA	NA	84-105	70-117	20	78-107
14808-79-8	Soluble Sulfate	SW-846 9056	NA	NA	90-110	75-125	20	90-110
18496-25-8	Total Sulfide	SW-846 9030B	NA	NA	85-110	60-99	56	76-107
7664-41-7	Ammonia Nitrogen	EPA 350.1/350.2	46-132	7	84-116	31-145	10	80-120
C-021	Total Kjeldahl Nitrogen	EPA 351.2	40-182	14	82-125	24-142	20	28-134
7723-14-0	Total Phosphorus	EPA 365.1	64-126	7	86-114	29-166	20	80-114
C-006	pH	SW-846 9045C	NA	NA	97-103	NA	5	97-103
C-012	Total Organic Carbon	EPA 415.1	NA	NA	85-115	75-125	20	82-120
C-008	Total Solids	EPA 160.3	NA	NA	86-114	NA	13	99-101
(4)	Grain Size	ASTM D422-63	NA	NA	NA	NA	NA	NA
U-004	Fecal Coliform Bacteria	SM 9221C	NA	20	NA	NA	NA	NA
C-004	Chemical Oxygen Demand	EPA 410.4	82-114	6	93-105	NA	NA	NA
C-002	Biochemical Oxygen Demand	EPA 405.1	NA	20	NA	NA	NA	NA
C-005	Nitrate/Nitrite Nitrogen	SW-846 9056	70-130 nitrite 62-133 nitrate	8 nitrite 7 nitrate	85-115 nitrite 89-111 nitrate	NA	NA	NA
14265-44-2	Orthophosphate	EPA 365.2	75-125	20	NA	NA	NA	NA
C-009	Total Suspended Solids	EPA 160.2	NA	21	67-118	NA	NA	NA
471341	Hardness	EPA 130.2	81 -116	3	93-107	NA	NA	NA

NOTES:

(1) The CAS # is fictitious for the combined 3- or 4-Methylphenol and for Wet Chemistry parameters which do not have true CAS #s.
(2) NA - Not Applicable.
(3) MS - Matrix Spike. MSD - Matrix Spike Duplicate. LD - Laboratory Duplicate. LCS - Laboratory Control Sample.
(4) Grain size will be reported by the percent in certain mm sieve. Therefore, a CAS# is not applicable to grain size.

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Metals								
7440-36-0	Antimony	SW-846 6010B	80-120	20	80-120	80-120	20	19-213
7440-38-2	Arsenic	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	71-129
7440-43-9	Cadmium	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	75-125
7440-47-3	Chromium	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	78-123
7440-50-8	Copper	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	80-120
7439-92-1	Lead	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	67-133
7439-95-4	Magnesium	SW-846 6010B	NA	NA	80-120	80-120	20	69-132
7439-97-6	Mercury	SW-846 7470A/7471A	80-120	20	80-120	80-120	20	62-138
7439-95-4	Molybdenum	SW-846 6010A	NA	NA	80-120	80-120	20	73-127
7440-02-0	Nickel	SW-846 6010B	80-120	20	80-120	80-120	20	75-125
7440-22-4	Silver	SW-846 6010B	NA	NA	80-120	80-120	20	72-128
7440-62-2	Vanadium	SW-846 6010B	NA	NA	80-120	80-120	20	64-136
7440-66-6	Zinc	SW-846 6010B	80-120	20	80-120	80-120	20	74-126
Simultaneously Extracted Metals								
7440-38-2	Arsenic	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-43-9	Cadmium	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-47-3	Chromium	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-50-8	Copper	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7439-92-1	Lead	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7439-97-6	Mercury	SW846-7470A	NA	NA	80-120	80-120	20	80-120%
7440-02-0	Nickel	SW846-6010B	NA	NA	80-120	80-120	20	80-120%
7440-66-6	Zinc	SW846-6010B	NA	NA	80-120	80-120	20	80-120%

SOP Number	Lancaster Laboratories Header Number	Title
AL-MET-01	5705, 5706	Sample Preparation of Wastewater and Extracts for Atomic Absorption (5706) and Inductively Coupled Plasma (5705) Analysis of Total Metals
AL-MET-02	5709, 5708	Sample preparation of sediments, sludges, and soils for analysis of metals by Atomic Absorption (5709) and Inductively Coupled Plasma Atomic Emission Spectrometry (5708)
AL-MET-03	SOP-IO-007	Preparation of Standards and Solutions
AL-MET-23	MC-IO-002	Operation of the Thermo Jarrell Ash ICAP™ 61 and ICAP™ 1100
AL-MET-24	SOP-IO-030	Operation of the Thermo Jarrell Ash ICAP™ 61E Trace Analyzer Spectrometer
AL-MET-04	SOP-IO-029	The Setup and Pouring of an ICP Run
AL-MET-05	SOP-IO-014.01	Reviewing ICP Data for Acceptance

National Environmental Testing

NET

Standard Operating Procedure

Title: Procedure for Chain of Custody

Category: Analytical

Reference: Internal

Revision Original Date Revised: 28 July 1993

Magnetic storage: Corporate Altos /usr/sop/

Filename: net.55.003r0

Approvals:

Division Manager

Director, Data Quality

Director, Technical Support
Organics

Director, Technical Support
Inorganics

Table of Contents

1. Introduction and Scope

An essential part of any sampling/analytical scheme is ensuring the integrity of the sample from collection to data reporting. The possession and handling of samples should be traceable from the time of collection through analysis and final disposition. Samples are physical evidence and should be handled according to procedural safeguards outlined in this SOP. Strict adherence to chain-of-custody procedures is especially critical if it is known that the analytical data or conclusions based upon analytical data will be used in litigation. Absolute adherence to chain-of-custody procedures is also required by certain state and/or federal agencies, e.g., USEPA CLP. If your division must meet internal COC requirements for your clients, a divisional specific SOP detailing the system used at the division should be prepared. In cases where litigation is not involved, many of the chain-of-custody procedures are still useful for routine control of sample flow. It is NET's policy to issue chain-of-custody froms with all bottle shipments and to ensure that the client submits chain-of-custody forms with the samples. Keep in mind that all analytical data can potentially be used for purposes of litigation at some time.

2. Summary

2.1. The chain-of-custody procedures used at NET are designed to ensure that sample integrity is maintained and documented from the time a sample is collected to its final disposition. It is the purpose of this SOP to outline these procedures.

2.2. To establish the documentation necessary to trace sample possession from the time of collection, a Chain of Custody Record should be filled out and accompany every sample. The record should contain the following minimum information. This information is required to allow the unique identification of every sample.

* Collector's sample identification
* Signature of collector
* Date and time of collection
* Place and address of collection
* Sample description
  - Number of containers of each sample
  - Preservatives
  - Desired analyses
  - Purchase order number
  - Client name, address and phone number
* Signatures of persons involved in the chain of possession

2.3. A sample is in custody when it meets one of the following requirements and can be documented as such. The sample handling procedures described in this SOP have been developed to ensure that these requirements are met.

2.3.1. It is in the actual possession of an authorized employee.

2.3.2. It is in their view, after being in their physical possession. This is the same as being in their custody for documentation purposes.

2.3.3. It was in their physical possession and then stored in a secure area.

2.3.4. It is in a secure area.

2.4. Sample labels are necessary to prevent misidentification of samples.

2.4.1. Labels commonly include the following information: NET Job, Sample #, client ID, date received, and disposal target date.

3. Safety

3.1. Each employee is directly responsible for complete awareness of all health hazards associated with every chemical that he/she uses. The employee must be aware of these hazards, and all associated protective wear and spill clean-up procedures PRIOR TO THE USE of any chemical. In all cases, both the applicable MSDS and supervisor or Safety Officer should be consulted. The employee should comply with all safety policies as presented in the NET Safety Manual. The bottle labels also provide important information that must be noted. If you have any questions, consult your supervisor or safety officer.

Personnel performing this procedure may be working with flammables, poisons, toxics, carcinogens, teratogens, mutagens, and biohazards. In particular, approved gloves, safety glasses, and labcoats must be worn, and solvents will be handled in ventilated hoods, in addition to other measures prescribed by the Division. It should be noted that samples must be handled with as much care as any of the materials used in this method due to the unknown nature of their composition.

3.2. All samples are potentially hazardous and any procedure involving the sample should be performed in a way that minimizes exposure to the sample. Avoid contact with the sample on skin or clothing. If contact occurs wash the affected area thoroughly. Do not "smell" the sample to determine odors or to classify the sample. An HNU meter can be used to screen samples. Labcoats, safety glasses and gloves must be worn when handling samples. If there is evidence of leakage from the sample bottle or if any noxious odors are evident it should be placed under a hood. Appropriate cleanup equipment (spill pillows, vermiculite, whisk broom, dust pan and a sealable container) should be in or near the login area to use in case a sample container breaks.

3.3. Sample coolers must be opened carefully and in such a manner as to avoid direct contact with the samples. Be aware that sample leakage could be present and this can cause odors. Again, if any odors are detected, the sample should be placed in a hood.

3.4. Any cooler containing a broken sample is considered contaminated. The client's Project Manager should be notified immediately. The Project Manager may need to contact the client to ascertain, if possible, the potential contaminants in the sample. The cooler should be cleaned and the remaining sample must be disposed of properly. If it is determined by the Project manager that the sample is in fact hazardous, then the sample must be handled and disposed of as hazardous waste.

3.5. Dispose of sample remains in a manner consistent with NET's Sample Disposal SOP, and local and state regulations / requirements.

4. Definitions

4.1. Secure Area: A secure area can be a locked refrigerator, a locked room, or a locked lab with restricted personnel entrance.

4.2. Hazardous Material: Any material or substance which, if improperly handled, can be damaging to the health and well being of people. Such materials cover a broad range of types which may be classified as poisons or toxic agents, corrosive chemicals, flammable materials, reactive materials, or radioactive chemicals.

5. Supporting Documents and Forms

5.1. Afterhours/Weekend Logbook

5.2. Chain-of-Custody form: This is a three part form available through NET's centralized purchasing system.

5.3. Sample Disposition and Follow-up

5.4. Sample Receipt Checklist

5.5. Purchase Order for Lab Analysis: Also a three part form available through NET's centralized purchasing system.

5.6. Interlab SOP

5.7. Sample Disposal SOP

5.8. Hazardous Waste Disposal SOP

6. Procedure

6.1. Initiation of the Chain-of-Custody

The chain-of-custody is initiated in the field by sample collection personnel. The sample collector is responsible for the care and custody of the samples until properly dispatched to the receiving laboratory or turned over to the sample custodian or designee. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or locked in such a place and manner to preclude tampering. Preservation requirements should be adhered to and samples should be delivered to the laboratory as soon as possible.

NOTE: Independent couriers are not required to sign the chain-of-custody form. Ideally, the chain-of-custody should be kept in the sealed sample cooler. The receipt from the courier should be kept with the chain-of-custody document in the master file.

6.2. Sample Receipt

Laboratory custody of the sample begins at sample receipt and the following procedures must be followed. These procedures ensure that sample receipt is done in such a way as to maintain the sample's integrity and to provide proper documentation.

6.2.1. Generally, samples are received by the NET sample control staff during normal working hours. Samples may be delivered by the following methods:

* Field sampling and mobile lab crews
* NET couriers
* Private courier services such as, Federal Express or UPS
* Hand delivered by clients or agents of the client
* US Mail

6.2.2. All samples are received by the sample custodian or his/her designee. The designee may be the person responsible for logging the sample into LABSYS2 or possibly shipping and receiving personnel. The sample custodian or the designee is responsible for signing the delivery forms for the carrier. The shipping containers are taken to the login area for completing the receiving process.

6.2.3. Samples received after normal working hours or on weekends are to be left in their coolers and placed in the walk-in cooler. The person receiving the samples must sign and date the Afterhours/Weekend Logbook. This logbook will be located in the sample receiving or login area. A form is provided as part of this SOP for this use. It can be copied and appropriately bound.

6.2.4. **The following applies only to samples received in accordance to a government contract, such as USEPA CLP or NEESA, or clients specifying this level of control.** If the project does not need this level of control, proceed to section **6.2.5.**, which specfies our routine procedures.

6.2.4.1. The sample custodian must examine the shipping containers and record the following information in a sample receipt logbook using a blue or black pen.

(1) The presence or absence of a custody seal on the shipping container must be recorded on the designated line in the sample login sheet.

(2) The custody seal number must be recorded if it is present.

(3) It must also be noted whether the custody seal is intact or broken.

6.2.4.2. The Sample Custodian will open the shipping container, remove the enclosed sample documents and record in the sample logbook:

(1) Presence/absence of the chain-of-custody record(s).

(2) Presence/absence of transmittance forms (Traffic Reports, Chronicles).

(3) Presence/absence of airbills and/or bills documenting shipments of samples. Airbill or airbill sticker numbers are to be recorded on the sample login sheet if present. If not present a line or N/A is to be entered in the appropriate area.

(4) The sample custodian (or designee) should measure and record the pH of any preserved samples,with the exception of volatile samples which are not to be opened and checked. If sample pH is not within protocol limits, record this in the sample receipt logbook. If all samples are within the specified ranges for pH, record this fact in the logbook as well. The protocol required pH limits are:

Analysis	pH
Cyanide	>12
Total Metals	
TKN, Nitrate and Nitrite	<2
Ammonia, TP, TOC,	
COD, phenols, O & G	

NOTE When the contract does not require this and pre-preserved sample containers have been used for sample collection, it is the responsibility of the

analyst to verify adequacy of preservation at the time the actual analysis is initiated.

6.2.5. The following applies to <u>all samples</u>. Routine samples are those not submitted in association with a government contract, such as USEPA CLP or NEESA and not requiring the level of control specified in section 6.2.4.

6.2.5.1. The temperature for each sample cooler should be recorded. The following options can be utilized:

(1) A 250 mL sample bottle contained in the cooler for this purpose can be utilized. The bottle should be appropriately marked to avoid mistaking it as a sample.

(2) Alternatively, insert thermometer into cooler and shut cooler. Allow thermometer to stabilize prior to obtaining a final reading. The acceptable temperature range is 4°C ± 2°C.

(3) Place the thermometer next to the exterior of a sample bottle inside the cooler.

(4) A probe that can be attached to a digital readout device can be placed in the cooler and the temperature read..

Whichever option is utilized, the protocol should be specified in the division specific appendix.

NOTE: Freezing is undesirable in a sample, since it could lead to breakage of glass containers.

6.2.5.2. Remove sample containers and all transmittals including chain-of-custody, freight bills and other documents. Record the following on the bottom of the chain-of-custody.

(1) Condition of sample containers (intact, leaking)

(2) Presence/absence of seal on cooler

(3) Presence/absence of sample tags (in addition to sample labels).

6.2.5.3. If sample tags are present:

Record sample tags document control number.

Compare with chain-of-custody record(s). If tag numbers are listed, check that they match the sample number. Document whether these numbers agree, or if there is a discrepancy between tag numbers received and those listed on the

chain-of-custody record. If sample tag numbers are not listed on the chain-of-custody, record this fact.

6.2.5.4. Compare the following documents to verify consistency of information contained on them: Chain-of-Custody Record, Sample Labels, Sample Tags (if present), Traffic Reports, and Airbills.

6.2.5.5. Note any discrepancies found. If discrepancies are found, contact the client submitting the samples for clarification and notify the appropriate laboratory personnel. Documentation of discrepancies, conversations with sample providers and resolutions should be noted, initialed, dated, and copied to the project file. A form entitled Sample Disposition and Follow-up is included in this SOP and it may be used to document such discrepancies. Copies of this form may be provided to the client upon resolution of a problem.

6.2.5.6. If all samples recorded on the chain-of-custody record were received by the lab and there are no problems observed with the sample shipment, the custodian or designee will sign the chain-of-custody record in "received for laboratory by" box on the document. If problems are noted, sign for shipment and note problems in the remarks box or make a reference to another form detailing the problems and record any resolution. The problem should be noted on the chain-of-custody form BRIEFLY, but full documentation including: date client was notified, initials of person notifying client, resolution of problem, actions required, etc. should be on file. A record of the resolution is filed in the project files. Proceed with login. Label the samples. Following log-in the samples are transferred to the area designated for sample splitting and distribution or storage.

6.2.5.7. Following sample splitting and distribution the paperwork generated at log-in and the chain-of-custody is submitted for final review to a project manager or customer service representative. After this review has been completed, the original COC is filed in a secure place. Copies may be submitted to laboratory personnel, but under no circumstance may an original chain-of-custody be circulated with the samples.

6.2.5.8. A form entitled Sample Receipt Checklist is included in this SOP. Usage is optional.

6.2.6. If there is no chain-of-custody, have the person delivering the samples fill one out or notify the client immediately. A faxed, signed form from the client is sufficient to allow receipt and analysis by the lab, however the client has already broken the integrity of the chain-of-custody from the field. Assuming NET did not do the sampling, this is not NET's

liability. Clients should be encouraged to use the proper procedures and forms.

6.2.7. Internal Chain of Custody

Occasionally, a state agency or a specific contract, e.g., NEESA or CLP requires internal chain-of-custody. In these cases, the contract laboratory is responsible for the storage and internal distribution of the sample. EACH and EVERY time responsibility for the sample changes from one individual to another, an entry of that change will be made on the internal chain-of-custody document and signed.

Since samples consist of aliquots for specific parameters, the flow of every aliquot and/or extract through the laboratory must be recorded on an internal chain-of-custody document.

Upon completion of the sample analysis, the chain-of-custody document and internal chain-of-custody documents shall be attached to the data report and forwarded to the requesting personnel.

A form for tracking COC internally is included in this SOP.

6.3. Maintaining Chain-of-Custody

6.3.1. If necessary, samples are split prior to distribution to the laboratory personnel responsible for performing the analysis. Samples awaiting analysis are refrigerated if necessary. The actual method SOPs specify preservation and storage requirements.

6.3.2. If a sample needs to be shipped to another NET division for analysis, NET's Internal Purchase Order for Lab Analysis needs to be completed. This form provides a section for documenting the chain-of-custody. It must contain the signatures signifiying the relinquishment and receipt of the samples. If this information is not obtained the chain-of-custody is broken. Pertinent information regarding the sample analysis particular to the project such as, Quality Assurance Project Plan (QAPP) or specific contract information, should also be sent to the division performing the analyses. A "normal" chain-of-custody could be used, but this does not negate the need to issue a Purchase Order specifying particular analytical requirements and agreed cost for analysis.

6.3.3. If a sample needs to be shipped to another lab outside the NET network, then a chain-of-custody and Purchase Order must be sent with the samples and request for analysis.

6.3.4. The original chain-of-custody forms should be kept on file for our permanent records. A copy of the chain-of-custody submitted by the client is normally sent with the final report. If for some reason the original chain-of-custody is released a note should be placed in the project file. It is recommended that the client be informed of all analyses conducted external to

the lab actually receiving the samples and that copies of all chain-of-custody forms are sent with the final report. Informing the client may consist of notification of our interlab policies and benefits during our initial contact with the client. A client may accept our judgement, or they may wish to be consulted prior to shipping samples to other locations for analyses each and every time a need develops. It is the responsibility of the division management team to be sensitive to client concerns and project requirements.

6.4. Chain-of-Custody of Sample in the Laboratory

In order to satisfy the custodial and evidentiary requirements of sample handling procedures, the following procedures have been developed and must be adhered to at all times.

6.4.1. Samples will be stored in a secure area.

6.4.2. Access to the laboratory will be through a monitored reception area. Other access doors to the laboratory will be kept locked. After working hours, it is recommended that the building be protected by a perimeter alarm system connected at the entrances to the building and by a motion detector system in the corridors of the building. The alarm system can be activated and deactivated by a code number entered on a keypad near the major entrances.

6.4.3. Visitors are escorted while in the laboratory.

6.4.4. After a sample has been removed from storage by the analyst, the analyst is responsible for the custody of the sample. Each analyst should return the sample to the storage area before the end of the working day.

6.5. Closing the Chain-of-Custody

The chain-of-custody is complete when the sample is used up, returned to the client, or disposed of in an appropriate manner.

1) Recommendation: If the sample is used up, a note should be made in the analytical notebook.

2) If the sample is returned to the client, a chain-of-custody should be on file documenting the transaction.

3) Normally, aqueous samples submitted for routine work are retained for approximately one month and solid samples submitted for routine work are retained for approximately three months in storage after releasing a final report. Samples from projects are also normally retained for three months. Samples are kept in refrigerated storage for as long as possible after completion of analyses. Due to space constraints, it is sometimes necessary to move them to a non-refrigerated storage area until final disposal.

Specialized arrangements which meet client requests or contractual requirements may be made with the laboratory which differ from the "normal" approach used for routine work. Specialized arrangements may include, refrigerated storage, longer storage, or documented disposal, i.e., signed and dated chain-of-custody or logbook.

7. References

7.1. "Test Methods for Evaluating Solid Waste", SW-846, 3rd Edition, Revised in November 1990.

7.2. "Example Standard Operating Procedures for Contract Laboratory Program (CLP) Laboratories", Nation Enforcement Investigation Center (NEIC), Contract Evidence Audit Team (CEAT-TechLaw), EPA Contract 68-01-6838, Revised 3-86.

8. Instructions for Bench References and Divisional Appendix

8.1. The bench reference consists of a short reference that can be used at the bench by trained analysts. They should never contain information that contradicts the SOP plus appendix. It may contain detail above and beyond the SOP plus appendix such as, sample storage locations, software specific instructions, or instrument specific information.

8.2. This SOP is intended for use at multiple NET Divisions. The SOPs may contain options, or may require additional clarification regarding items such as, calibration standards, spiking procedures, or materials actually utilized to perform the analysis. The mechanism for communicating the choice of options and clarifications is a division specific appendix. In addition, if a division is using modifications of the SOP, the modifications must be approved by the Corporate Technical Support Staff and documented in this appendix. The use of modifications not documented in the appendix is not permitted. Some SOPs allow the user to replace the recommended apparatus with equivalent apparatus. When allowances are made in an SOP for the use of equivalent apparatus, documenting their use in the appendix is not required.

8.3. If a modification improves the efficiency and/or performance of the method, please submit a Request for Document Change Form. This form can be found in the SOP. It is important that we continue to improve this SOP for use by all divisions within NET.

8.4. Attach a type written explanation of any options, clarifications, or modifications used by the division. As a rule of thumb, include information in the appendix that eliminates questions arising when training is being performed. It is important that all users of the SOP know which options and modifications are being used. Each item within the Appendix should refer to the pertinent section within the SOP. If desirable, the Appendix can be referenced within the body of the SOP by placing the term "See Section 12.___".

The upper right hand corner of each page of the Appendix should contain the following:

.HE4 (in far left-hand corner)

Method GC Herb 8150. Division Name
Revision No. ?
Date: ?
Appendix Page # of ?

The following will be sent back to the division once the appendix has been approved:

APPROVAL OF DIVISION SPECIFIC APPENDIX

Division:_____

SOP Manual ID:_____

Method:_____

Revision no. of SOP:_____

SOP Magnetic Repository:_____

Revision no. of Appendix:_____

Appendix Magnetic Repository:_____

Approvals:

_____ _____

Division Manager Director, Technical Support

Date:_____ Date:_____

_____

Director of Data Quality

Date:_____

SAMPLE RECEIPT CHECKLIST

Client_____NET Job No._____

Samples Shipped	UPS	Fed Ex	Other:
Samples Hand Delivered	Client		Other:

	Yes	No	Comments:
1. COC Present?			
2. COC Seal on Shipping Container?			
3. COC Seal on Sample Containers?			
4. Samples Chilled? Temp of Cooler_____			
5. Samples Rec'd Intact?			
6. Zero Headspace for VOCs?			
7. Correct Containers Used?			
8. Adequate Volume Provided?			
9. Samples Preserved Correctly			
10. Samples Received within Holding Time?			
11. Agreement between COC and Sample Labels?			
Additional Comments:			

Inspected By:_____ Date/Time:_____

NET, Inc.

SAMPLE DISPOSITION AND FOLLOW UP

Client Name/Location_____Date:_____

Contact Person:_____Phone No.:_____

Date Received:_____Client ID:_____

NET Job No._____Sample No(s).._____

STATEMENT OF PROBLEMS:

[ ] Chain of custody missing/not filled out properly
[ ] Damaged container(s)
[ ] Missing container(s)
[ ] Inadequate sample volume
[ ] Inappropriate container(s) / preservatives
[ ] Unauthorized RUSH request
[ ] Sample(s) do not match Client Program/Sales Order
[ ] Sample identification unclear
[ ] Missing information / paperwork
[ ] Other:_____

_____

_____

_____

PROPOSED REMEDY:_____

_____

_____

_____

Internal Use:

Date:_____Initials:_____Contact Person:_____

Resolution/Disposition of Sample:_____

_____

_____

_____

-ATTACH TO LAB OFFICE COPY OF SAMPLE WORK ORDER-

NET, Inc.

AFTERHOURS/WEEKEND LOG

Date	NET Contact	From (Client)	Delivered By	No. of Coolers	Received By

NET, Inc.

NET NATIONAL ENVIRONMENTAL TESTING, INC.

PURCHASE ORDER FOR INTERLAB ANALYSIS

PURCHASE ORDER # _____ DATE SHIPPED _____

SENDING DIVISION _____ RECEIVING DIVISION _____

NEGOTIATED BY _____ APPROVED BY _____

TELEPHONE # _____ TELEPHONE # _____

SAMPLE DUE DATE _____ HOLDING TIME _____

Sample #	Matrix	Sample Vol.	Parameter	Price	Comments

Additional Comments & Special Requests _____

_____

Circle QC Deliverable Level Required: II (no cost)

III (up to 10%)

IV (up to 15%)

Price Per Sample _____ # of Samples _____ Rush Charge _____ QA Charge _____ Sub Total _____

Discount _____ % TOTAL PURCHASE ORDER _____

Reporting Limits _____ (if necessary, provide attahcment)

Digested: Y or N, if no, does the receiving division need to digest the sample? Y or N

CHAIN OF CUSTODY

	SIGNATURES	DATE/TIME
1. Relinquished By:	_____	_____
2. Received By:	_____	_____
3. Relinquished By:	_____	_____
4. Received By:	_____	_____

Cooler Temperature: _____

PLEASE SIGN, DATE AND TIME THIS CUSTODY FORM AND RETURN THE ORIGINAL WITH THE FINAL REPORT. THE INVOICE MUST NOT EXCEED THE PURCHASE ORDER AMOUNT WITHOUT PRIOR APPROVAL AND AMENDMENT TO THIS PURCHASE ORDER.

NET NATIONAL ENVIRONMENTAL TESTING, INC.®

CHAIN OF CUSTODY RECORD

COMPANY _____
ADDRESS _____
PHONE _____ FAX _____
PROJECT NAME/LOCATION _____
PROJECT NUMBER _____
PROJECT MANAGER _____

REPORT TO: _____
INVOICE TO: _____
P.O. NO. _____
NET QUOTE NO. _____

SAMPLED BY

(PRINT NAME) _____ SIGNATURE _____

(PRINT NAME) _____ SIGNATURE _____

DATE	TIME	SAMPLE DESCRIPTION	GRAB	COMP	# OF CONTAINERS	TYPE	MATRIX	PRESERVED	ANALYSES	COMMENTS

CONDITION OF SAMPLE: BOTTLES INTACT? YES / NO
FIELD FILTERED? YES / NO
COC SEALS PRESENT AND INTACT? YES / NO
VOLATILES FREE OF HEADSPACE? YES / NO
TEMPERATURE UPON RECEIPT: _____

SAMPLE REMAINDER DISPOSAL: RETURN SAMPLE REMAINDER TO CLIENT VIA _____
I REQUEST NET TO DISPOSE OF ALL SAMPLE REMAINDERS _____ DATE _____

RELINQUISHED BY:	DATE/TIME	RECEIVED BY:	RELINQUISHED BY:	DATE/TIME	RECEIVED FOR NET BY:

METHOD OF SHIPMENT

REMARKS:

STANDARD OPERATING PROCEDURE FOR pH MEASUREMENTS

1. OBJECTIVES

The objective of this SOP is to obtain a representative pH measurement of an aqueous sample while in the field using both a pH meter and pH paper.

2. EQUIPMENT

1. Portable pH meter
2. Combination pH electrode and temperature probe
3. pH indicator paper, such as Hydrion, to cover the pH range 1 through 10. pH paper is available in a variety of ranges, depending on the accuracy required. However, if fairly accurate results are required, an instrument measurement is preferred.
4. Distilled or deionized water
5. pH standard solutions (usually at pH 4.0, 7.0, and 10.0)
6. Magnetic stirrer and bar (if measurements can be performed in a field office)

3. PROCEDURE

It is important to obtain a pH measurement soon after obtaining a sample and thus avoid sample changes such as precipitation, temperature fluctuation, or oxidation which can affect the pH of the sample.

3.1 pH MEASUREMENTS

<u>pH Meter</u>

1. Rinse the electrode and probe with distilled or deionized water.

2. Immerse the electrode and probe in the solution or sample. Gently stir the water with the electrode or the stir bar.

3. After the reading stabilizes, record the pH of the solution to the nearest 0.1 standard pH unit.

4. Rinse the electrode and probe with distilled or deionized water.

5. Keep the electrode immersed in water at all times when not in use or put the end cap (partially filled with water) on the tip of the electrode.

Indicator Paper

This technique will only be used to obtain an approximate pH, such as when preserving a sample.

1. Pour a small amount of the unknown solution onto a strip of indicator paper or transfer a small aliquot of the sample onto the indicator paper using a clean disposable capillary dropper. Do not dip the indicator paper into the solution.

2. Compare the color with the indicator colors given on the pH paper container.

3. Record the pH. (Note: If the indicator paper is suspected of being old or deteriorated, immerse it in an appropriate buffer and check the color that develops against the standards given.)

3.2 METER MAINTENANCE

1. General maintenance: Store electrodes according to procedures given on the electrode manufacturer's instruction sheet.

2. Monthly maintenance: Check the battery level, and replace batteries as needed.

3. After-use maintenance: Check batteries after each use.

4. Functional maintenance: Refer specific maintenance or repair needs to the manufacturer or other qualified service personnel.

3.3 METER CALIBRATION

The meter will be calibrated each day before any readings are made. Calibration will be checked with pH 7 buffer midway through the day and with both buffers at the end of the day. Use buffer solutions that bracket the expected pH measurements. Generally, buffer solutions at pH 4.0, 7.0, and 10.0 will suffice. If a sample has a pH outside the 4-10 range, then the

instrument will have to be recalibrated using buffers other than 4.0 or 10.0 that bracket the sample pH. This procedure assumes the meter compensates for temperature.

1. Check the condition of the electrode tip. If the tip has not been stored with water, immerse the electrode tip in water for at least an hour before use, preferably overnight.

2. Rinse the electrode with distilled or deionized water.

3. Immerse the electrode and temperature probe in pH 7 buffer solution.

4. Adjust the pH meter to read 7.0.

5. Rinse off the electrode and temperature probe with distilled or deionized water.

6. Immerse the electrode and probe in pH 4 or pH 10 buffer depending on whether the samples are expected to be acidic or basic.

7. Calibrate the pH meter to read the pH of the buffer solution.

8. Remove the electrode from the buffer and rinse them thoroughly with distilled or deionized water.

9. Document the time and date of calibration and pH buffer solutions used for calibration in the field log book or calibration record.

STANDARD OPERATING PROCEDURE FOR DISSOLVED OXYGEN CONTENT MEASUREMENTS

1. OBJECTIVES

This procedure describes how to measure the dissolved oxygen (D.O.) content of an aqueous sample.

2. EQUIPMENT

1. Portable dissolved oxygen meter and probe (Yellow Springs, Inc. Model 5/B)
2. D.O. membrane kit
3. Potable water
4. Distilled or deionized water

3. PROCEDURE

These procedures apply specifically to the Yellow Springs Inc. Model 5/B Dissolved Oxygen (D.O.) Meter. If another instrument is used, procedures identified in the instrument's instruction manual should be followed.

3.1 DISSOLVED OXYGEN MEASUREMENT

1. Rinse the probe with distilled or deionized water.

2. Manually stir the probe in the sample.

3. Allow sufficient time for the D.O. probe to stabilize to the sample temperature and dissolved oxygen content.

4. Set the control switch to the TEMP position and read the temperature from the lower meter scale. Set the O_2 SOLUBILITY FACTOR dial to the observed temperature, taking care to use the appropriate salinity index.

5. Set the control switch to the READ O_2 position and read the dissolved oxygen value in mg/L directly from the meter. Record the sample D.O. measurement in mg/L.

6. Rinse the probe with distilled or deionized water.

3.2 MAINTENANCE

1. General maintenance: Store probe according to procedures given in the dissolved oxygen probe instructions.

2. Monthly maintenance: Check battery level and replace, if necessary.

3. After use maintenance: Check battery level after each use. Check the membrane located at the electrode tip after each use. If the membrane is dirty, torn, not securely fastened, or if there is an air bubble on the other side, replace the membrane.

4. Functional maintenance: Refer specific maintenance or repair needs to the manufacturer or other qualified service personnel.

5. When the probes are not in use, store them according to the manufacturer's prescribed procedures so that the membrane does not dry out.

3.3 CALIBRATION

Calibrate the D.O. probe and meter daily before field work begins. Initial calibration can be disturbed by physical shock, touching the membrane, altitude changes, fouling of the membrane, or the drying of the electrolyte. Check instrument calibration before each set of measurements, and again at the end of the day.

1. Before field work begins each day, check the integrity and cleanliness of the D.O. probe's membrane. If the membrane is broken, dirty, or has a bubble behind it, replace the membrane.

2. With the control switch set to the OFF position, adjust the meter pointer to zero using a screw driver to adjust the screw located in the center of the meter panel. Do not force this adjustment, as the meter may be damaged by this operation.

3. Turn the control switch to the ZERO position and adjust the meter reading to zero with the ZERO knob.

4. Set the control switch to the FULL SCALE position and adjust the FULL SCALE knob until the meter needle aligns with the 15 mark on the mg/L scale.

5. Attach the probe to the probe connector of the instrument and tighten the retaining ring finger tight.

6. Before calibrating, allow 15 minutes for optimum probe stabilization and polarization. Allow 15 minutes for repolarization whenever the instrument has been off, or the probe has been disconnected.

7. Calibrate the D.O. instrument using either the Water Saturated Air Method or the Air-Saturated Water Method. Details of these procedures are described in Sections 3.3.1 and 3.3.2, respectively.

3.3.1 Water Saturated Air Calibration Method

1. Place the probe in a BOD bottle containing about 1 inch of water. Wait approximately ten minutes for temperature stabilization. The 5739 D.O. probe can be placed in the YSI 5075A Calibration Chamber or in the small calibration bottle supplied with the probe (the one with the hole in the bottom) along with a few drops of water, or a moistened towel or cloth.

2. Read the temperature and refer to the instrument's Calibration Table to determine the proper calibration value. NOTE: To achieve the stated accuracy of measurement, the probe must be stabilized before calibrating. The calibration temperature should be within 5 degrees Celsius of the sample temperature.

3. Determine the atmospheric correction factor (see instrument instructions).

4. Multiply the calibration value by the atmospheric correction factor.

5. Switch the instrument to an appropriate mg/L range and adjust the CALIBRATE control until the meter reads the calibration value computed from step 4. Without changing the calibration setup, monitor the readings for an additional 3 minutes to verify calibration stability. Readjust if necessary.

6. Document the D.O. meter calibration in the field notes or on a calibration record form. Record the date and time of the calibration and all calibration checks.

3.3.2 Air Saturated Water Calibration Method

1. Saturate 300 to 500 milliliters of distilled or distilled, deionized water with air by shaking it for at least 3 minutes or by allowing the water to be exposed to the air overnight at a relatively constant temperature.

2. Place the probe in the water and manually stir the water with the probe.

3. Turn the function switch to the TEMPERATURE position and wait for the temperature reading to stabilize.

4. Set the dial to the temperature reading on the meter for fresh water.

5. Turn the function switch to the CALIB O_2 position, then adjust the CALIB knob so the needle reads the local altitude. Leave the probe in the water for two minutes to verify stability.

6. Turn the function switch to READ O_2 position and read the dissolved oxygen content in mg/L.

7. Determine the solubility of oxygen in fresh water by multiplying its solubility at the measured temperature determined by reading Table I (attached) by the appropriate correction factor based on either atmospheric pressure or altitude from Table II (attached).

8. Compare the corrected oxygen solubility to the measured dissolved oxygen concentration in the water. If the two numbers differ by more than 0.2 mg/L, shake the water for 5 to 10 minutes, repeat the calibration procedure, and recalculate the corrected oxygen solubility. If the two numbers still differ by more that 0.2 mg/l, refer to the instrument manual, or call the instrument supplier or manufacturer.

9. Document the D.O. meter calibration in the field book or on a calibration record form. Record the date and time of calibration.

STANDARD OPERATING PROCEDURE FOR TEMPERATURE MEASUREMENTS

1. OBJECTIVES

This procedure describes the steps required to measure the temperature of a groundwater or surface water sample.

2. EQUIPMENT

1. Portable meter with temperature probe or a field-grade thermometer with liquid such as alcohol (not mercury) using Celcius scale
2. Certified calibrated mercury thermometer traceable to the National Institute of Science and Technology using Celcius scale
3. Distilled or deionized water

3. PROCEDURE

3.1 TEMPERATURE MEASUREMENT

1. Collect an aqueous sample in accordance with the appropriate SOP.

2. Rinse the temperature probe or field-grade thermometer with distilled or deionized water.

3. Measure the temperature by immersing the temperature probe or thermometer bulb in the sample.

4. Record the temperature in °C when the reading stabilizes. Apply any necessary correction factors for the field-grade thermometer of temperature and record the true temperature in °C.

3.2 MAINTENANCE

Meter

1. General maintenance: Store the probe according to procedures in the instruction manual.

2. Monthly maintenance: Check the battery level, and replace batteries as needed.

3. After-use maintenance: Check batteries after each use.

4. Functional maintenance: Refer specific maintenance or repair needs to the manufacturer or other qualified service personnel.

Thermometer

None

3.3 CALIBRATION

Verify the calibration of the temperature probe or field-grade thermometer at least annually by comparing the certified thermometer temperature reading to the probe or thermometer temperature readings in an ice-and-water bath and in a hot water bath. If the readings vary more than 1°C from the certified thermometer temperature reading, then replace the field grade thermometer or adjust the probe according to the meter's instruction manual. Alternatively, label the field thermometer or probe with the compensation factor in °C that temperature measurements must be adjusted by to read the true temperature. Record the calibration in the field notebook.

STANDARD OPERATING PROCEDURE FOR MEASUREMENT OF SPECIFIC CONDUCTIVITY

1. OBJECTIVES

This document details the steps required to measure the specific conductance of an aqueous sample while in the field.

2. EQUIPMENT

1. Specific conductivity meter and probe.
2. Distilled or deionized water.
3. Standards for conductivity (100 and 1,000 umhos/cm are suggested).

4. PROCEDURE

It is important to obtain a specific conductance measurement soon after taking a sample since temperature changes, precipitation reactions, and absorption of carbon dioxide from the air (or degassing of carbon dioxide to the air) all affect the specific conductance. The sample will be obtained in accordance with the appropriate SOP (GT031, SC001, SC011).

3.1 SPECIFIC CONDUCTIVITY MEASUREMENTS

These procedures apply specifically to the Yellow Springs, Inc. salinity-conductivity - temperature (YSI S-C-T) Meter Model No. 33. If another instrument is used, the instruction manual measurement procedures will be followed.

1. Adjust meter zero (if necessary) by turning the bakelite screw on the meter face so that the meter needle coincides with the zero on the conductivity scale.

2. Check the battery by turning the MODE control to REDLINE and adjusting the REDLINE control so the meter needle lines up with the redline on the meter face. If this cannot be accomplished, replace the batteries.

3. Plug the probe into the probe jack on the side of the instrument.

4. Rinse the probe with distilled or deionized water, then shake water off probe.

5. Put the probe in the sample to be measured. Gentle agitation by raising and lowering

the probe several times during a measurement insures flow of specimen solution through the probe and improves the time response of the temperature sensor.

6. Switch to temperature. When the temperature reading stabilizes, record the temperature and set the temperature knob to the water sample temperature.

7. Switch to the X100 conductivity scale. If the reading is below 50 on the 0-500 range, switch to the X10 conductivity scale. If the reading is still below 50, switch to the X1 scale. Read the micromhos number from the meter face and multiply the reading by the conductivity scale setting. The reading will be in micromhos/cm. Measurements are not temperature compensated.

   Example
   Meter Reading: 247
   Scale: X10
   Temperature: 14°C
   Answer: 2470 micromhos/cm at 14°C

8. When measuring on the X100 and X10 scales, depress the Cell Test button. The meter reading should fall less than 2%; if greater, the probe is fouled and the measurement is in error. Clean the probe and re-measure.

9. Rinse the probe with distilled or deionized water.

10. All specific conductivity measurements of samples will be corrected to 25°C using the following equation:

Using the calculated cell constant (See Section 4.3) and the following formula, field specific conductance measurements must be corrected to 25°C.

$$S = \frac{K \bullet C}{1 + 0.02\ (T-25)}$$

Where:

S = specific conductance at 25°C (umhos/cm)
K = calculated cell constant
C = field specific conductance (umhos/cm)
T = temperature (°C) of sample at which conductance was measured

3.2 MAINTENANCE

1. Replace batteries when necessary.

2. If the specific conductance measurements become erratic or inspection shows that any of the platinum black has flaked off the electrode, replatinization of the electrode is necessary. See the manufacturer's instruction manual for details.

3.3 CALIBRATION

This procedure applies specifically to the YSI S-C-T meter Model No. 33. If another instrument is used, the instruction manual calibration procedures will be followed. This procedure determines whether the meter is reading accurately.

Calibration will be performed each day prior to any sample measurements. The instrument calibration will be checked on one standard at lunch time and after sampling is complete for the day. Record all calibration results and checks in the field notebook or calibration record form.

Follow the procedures presented in Section 3.1 of this SOP to measure at least one standard solution at 1,000 micromhos/cm. The use of 100 and 1,000 micromhos/cm standards are suggested for most environmental samples. If the readings, adjusted to 25°C, are not within $\pm$ 10% of the conductance for both standards, don't use the instrument. Refer to the instruction manual, instrument supplier, or the manufacturer to adjust or repair the instrument.

The conductivity probe cell constant will be calculated according to the formula:

$$K = \frac{E}{C}$$

Where:

K = probe cell constant (unitless)
C = measured conductance value of 1,000 micromho/cm standard
E = expected conductance at the observed standard solution temperature from Table 1

Table 1 is used to correct for the 1,000 umho/cm standard solution's conductivity value if it is not at 25°C

Table 1
Conductivity Temperature Corrections for 1,000 umhos/cm Conductivity Standard

Temperature, °C	umhos/cm
0	604
1	616
2	629
3	642
4	655
5	668
6	682
7	696
8	709
9	724
10	739
11	754
12	769
13	785
14	801
15	817
16	834
17	851
18	868
19	886
20	904
21	922
22	941
23	960
24	980
25	1,000
26	1,020
27	1,040
28	1,061
29	1,082
30	1,104
31	1,126
32	1,148
33	1,171
34	1,194
35	1,218

DuPont Specialty Chemicals
Barley Mill Plaza-Bldg. 27
Lancaster Pike and Rt. 141
Wilmington, DE 19805

DuPont Specialty Chemicals

U.S. EPA, Region 5
Waste Pesticide and Toxics Division
Enforcement and Compliance Assurance Branch
77 West Jackson Boulevard, DRE-9J
Chicago, Illinois 60604-3590

April 24, 1998

Attn: DuPont-East Chicago Project Coordinator
RCRA Corrective Action Order IND 005 174 254

RE: Sediment Characterization Work Plan QAPP

Dear Mr. Wojtas:

Pursuant to RCRA Corrective Action Order IND 005 174 254, DuPont is enclosing three copies of the Sediment Characterization Work Plan Quality Assurance Project Plan your review. Additional copies have been submitted to your contractor and the Indiana Department of Environmental Management (IDEM). We look forward to discussing the plan with EPA and IDEM in several weeks. As we discussed the Sediment Characterization Work Plan will be submitted with the agreed upon modifications by April 30, 1998.

If you have any questions please feel free to call David Epps at (302) 992-6592 or myself at (704) 362-6628.

Sincerely,

J. Hilton Frey /mg

J. Hilton Frey
DuPont Corporate Remediation Group
Project Director

cc: Chris Myer, IDEM
Ross Austin, DuPont
Kathy Shelton, DuPont
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CERTIFICATION

Pursuant to section XV of the RCRA Corrective Action Order, the following certification is provided:

"I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to evaluate the information submitted. I certify that the information contained in or accompanying this submittal is true, accurate, and complete. As to those identified portions of this submittal for which I cannot personally verify the accuracy, I certify that this submittal and all attachments were prepared in accordance with procedures designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those directly responsible for gathering the information or the immediate supervisor of such person(s), the information submitted is, to the best of my knowledge and belief true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations"

Signature: J Hilton Frey/Jmc

Name: J. Hilton Frey

Title: Project Director

Date: April 23, 1998

QUALITY ASSURANCE PROJECT PLAN

FOR THE RCRA SEDIMENT CHARACTERIZATION STUDY AT

E.I. DU PONT DE NEMOURS AND COMPANY'S

CHEMICAL MANUFACTURING PLANT IN EAST CHICAGO, INDIANA

U.S. EPA ID NUMBER IND 005 174 254

REVISION 0

APRIL 23, 1998

Prepared by: Environmental Standards, Inc.

Prepared for: DuPont Corporate Remediation Group

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TABLE OF CONTENTS

Page

Page

Page

Page

Page

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

Attachment No.	Description
F1	Data Quality Objectives
F2	Lancaster Laboratories Volatiles Preparation and Analysis SOPs
F3	Lancaster Laboratories Semivolatiles Preparation, Clean-up, and Analysis SOPs
F4	Lancaster Laboratories Organochlorine Pesticide/PCB and PCB only Preparation, Clean-up, and Analysis SOPs
F5	Lancaster Laboratories Organochlorine Herbicide Preparation and Analysis SOPs
F6	Lancaster Laboratories General Gas Chromatography SOPs
F7	Lancaster Laboratories Metals Preparation and Inductively Coupled Plasma (ICP trace) Analysis SOPs
F8	Lancaster Laboratories Mercury Preparation and Analysis SOPs
F9	Lancaster Laboratories Metals Preparation and Graphite Furnace Atomic Absorption (GFAA) Analysis SOPs
F10	Lancaster Laboratories Wet Chemistry Preparation and Analysis SOPs
F11	NET Wet Chemistry Preparation and Analysis SOPs
F12	Lancaster Laboratories Internal Chain-of-Custody Documentation SOP
F13	Lancaster Laboratories Analytical Method Validation and Method Detection Limit Determination SOPs
F14	Data Validation SOPs
F15	Lancaster Laboratories Example Reporting Forms
F16	Field Audit Checklist
F17	Lancaster Laboratories Audit Checklist
F18	NET Audit Checklist

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SECTION 1

PROJECT DESCRIPTION

1.0 Project Description

The E.I. du Pont de Nemours and Company (DuPont) has entered into an agreement with the US Environmental Protection Agency (US EPA) pursuant to Resource Conservation and Recovery Act (RCRA) Corrective Action Order (Order) IND 005 174 354 (US EPA 1997), dated June 25, 1997, to conduct an investigation of the sediments within a portion of the East Branch (the study area) of the Grand Calumet River (GCR) adjacent to DuPont's East Chicago Facility. This document presents the quality assurance project plan (QAPP) for the Sediment Characterization Study (SCS). The SCS will be completed in a phased approach to allow for the collection of data in a logical and scientific manner.

1.1 Introduction

This QAPP is an integral part of the approved "Sediment Characterization Study Work Plan for the DuPont East Chicago Facility" (SCS Work Plan). This QAPP presents the organization, objectives, planned activities, and specific quality assurance (QA)/quality control (QC) procedures associated with the Phase I SCS for the DuPont East Chicago Facility. Specific protocols for sampling, sample handling and storage, Chain-of-Custody, and laboratory and field analyses will be described. All QA/QC procedures will be structured in accordance with applicable US EPA requirements, regulations, guidance, and technical standards. This QAPP was prepared in accordance with a guidance manual entitled "Region 5 Model RCRA Quality Assurance Project Plan," May, 1993.

This QAPP has been prepared on behalf of DuPont by Environmental Standards, Inc. (Environmental Standards). DuPont has previously submitted the "Current Conditions Report for the DuPont East Chicago Facility," prepared by CH2M Hill, under a separate cover on October 28, 1997. The Current Conditions Report (CCR) presented DuPont's understanding of site conditions based on a consolidation of existing information available for review, and the report should be considered entirely incorporated into the QAPP through specific reference. In addition, a Project Management Plan, a Field Sampling Plan (FSP), a Data Management Plan, a Health and Safety Plan, and a Community Relations Plan have been appended to the SCS Work Plan, prepared by PTI Environmental Services (PTI). This QAPP has also been prepared to be entirely incorporated into the SCS Work Plan as Appendix F.

It is DuPont's belief that the sediment investigation outlined in the SCS Work Plan should be guided by the principles of the Great Lakes Water Quality Agreement of 1978. In order to evaluate environmental improvements that may be achieved in a specific area of concern, an understanding of what has impaired or is still impairing the beneficial uses of that area of concern is required. As such, the SCS Work Plan has incorporated into the design of the sediment investigation specific tasks that will identify where data gaps exist and potential sources of information (i.e., scientific literature, sediment sampling, etc.) that will be used to develop a better understanding of the GCR at local and regional levels. This knowledge will allow the regional stakeholders to begin to evaluate the potential benefits of various remedial alternatives in meeting the goal of environmental improvement for the Indiana Harbor Canal, GCR, and Nearshore Lake Michigan Area of Concern (AOC). Recognizing that unknown or poorly understood variables are inherent in investigations of complex systems, the SCS will be completed in a phased approach. This approach allows data to be collected in a logical and scientific manner.

1.1.1 Overall Project Objectives

Specific objectives for the Phase I SCS are:

- To meet the intent of the Order by investigating the presence of constituents that may be related to the DuPont East Chicago Facility in sediments of the East Branch of the GCR and adjacent wetlands and eventually compare this data to the "Ecological Data Quality Levels RCRA Appendix IX Hazardous Constituents, US Environmental Protection Agency, Region 5";

- To develop a conceptual understanding of physical and chemical processes that affect constituent distributions in the study area;

- To collect information on the beneficial uses that are alleged to have been impaired in the study area, as well as information that will contribute to an understanding of the causes of those impaired uses;

- To collect information on past and present constituent loading to the East Branch of the GCR that will contribute to an understanding of how those constituents have contributed to the impaired uses.

1.1.2 Project Scope-of-Work

In order to meet the project objectives, the following activities will be completed.

- Existing data review;
- Environmental media sampling; and
- Data evaluation.

Available information/data on the physical and chemical conditions within the GCR will be assembled and evaluated to clarify the conceptual model and will determine if the field investigation proposed in the SCS Work Plan adequately meets the project objectives. Currently, this program consists of:

- Surface sediment (0 to 10 cm) sampling;
- Near-surface sediment (10-20 cm and 20-30 cm) sampling;
- Deep sediment core sampling;
- Wetlands surface sediment sampling;
- Surface water sampling; and
- Surface water hydrology and sediment dynamics assessment.

Sediment samples will be analyzed collectively for the parameters listed in Table F1-1. Surface water samples will be analyzed collectively for the parameters listed in Table F1-2.

At the conclusion of the Phase I investigation, DuPont will evaluate whether the SCS data are sufficient to develop a comprehensive understanding of processes presently affecting contaminant transport and fate in the study area and to evaluate the current status of impaired beneficial uses. This evaluation will be a determining factor in decisions regarding the necessity for additional field and laboratory studies of sediment and/or surface water in a subsequent SCS phase. After considering the SCS and existing data, DuPont will prepare the Phase I SCS report, which will include any

recommendations for additional data collection, if any, in a subsequent phase of the SCS. If, after consultation with the US EPA Region 5 and the Indiana Department of Environmental Management (IDEM), it is decided that an additional phase of the SCS is required, it will be described in an amendment to the SCS Work Plan and QAPP. The rationale and scope of any Phase II investigation will be discussed with and approved by the US EPA prior to implementation.

1.1.3 QAPP Preparation Guidelines

As explained above, this QAPP has been prepared in accordance with the "Region 5 Model RCRA Quality Assurance Project Plan", dated May, 1993. Furthermore, a meeting was held with the US EPA in which the Region's protocol for preparation of QAPPs was reviewed. Additional guidance was received at the meeting on how to prepare this QAPP. This meeting was a formal "pre-QAPP" meeting. At the meeting, representatives from the US EPA's Environmental Sciences Division were present and available for consultation with representatives of DuPont, Environmental Standards, Inc., and Lancaster Laboratories.

1.2 Site/Facility Description

A brief description of the facility, its geological setting, and associated features is presented in the section below.

1.2.1 Location

The DuPont East Chicago Facility is a chemical manufacturing plant located at 5215 Kennedy Avenue, East Chicago, in Lake County, Indiana. The DuPont East Chicago Facility property is located along the East Branch of the GCR between Cline Avenue and Kennedy Avenue. Maps of the facility property are provided as Figures 2-1 and 2-2 of the SCS Work Plan. Development occurred primarily on the western part of the property. The southern part of the developed area was used for manufacturing purposes (the "primary manufacturing area") while the northern part and the eastern edge of the developed area were used for waste management purposes. The eastern part of the property (the "natural area") has not been developed.

The study area for the East Chicago SCS is the portion of the East Branch of the GCR from Cline Avenue downstream to the confluence, including the Indiana Harbor Canal

and the adjacent wetlands (the wetlands upstream of the historical DuPont outfalls and the wetlands adjacent to the Harbison-Walker and U.S.S. Lead facilities).

1.2.2 Facility/Size and Borders

The approximately 440-acre East Chicago Facility property is bounded on the west by Kennedy Avenue, on the north and northeast by the Indiana Harbor Belt Railroad, on the east by the Chicago South Shore and South Bend Railroad and a property owned by the City of East Chicago, and on the south by the East Branch of the GCR. The East Chicago Facility is one of hundreds of industrial facilities located within an industrial region defined by Lake Michigan to the north, Interstate 94 to the south, the Indiana/Illinois border to the west, and the eastern edge of the City of Gary to the east.

Sections entitled "Regional and Site Development Overview" and "Surrounding Land Use" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-1 through 2-2). These sections of the CCR provide additional detail regarding the setting of the East Chicago Facility.

1.2.3 Natural and Manmade Features

Today, the East Chicago facility comprises four main areas: (1) the active manufacturing area; (2) the previously active manufacturing area; (3) waste management areas outside the manufacturing areas; and (4) a natural area.

Site development included regarding and construction of manufacturing buildings, utilities, and roadways. A significant part of the land surface within the manufacturing areas was compacted and paved during site development. Though all the aboveground facilities in this previously active manufacturing area have been removed, foundations, building rubble, and pavement can be seen on the land surface in many of the former operating areas. Limited vegetative cover or habitat has existed historically within the manufacturing and waste management areas of the facility. General refuse, wastewater treatment filter cake, process filter cake, ash, construction debris, and demolition debris were disposed of on land north of manufacturing operations. Only one landfill area remains active today. Vegetation is reestablishing itself over most of the inactive manufacturing and waste management areas. The original region consisted of a series of beach ridges separated by swales with many marshy areas. Within the natural area, a remnant ridge and swale (also referred to as dune and swale) community is present.

With specific regard to the study area, the GCR currently flows from east to west into Lake Michigan through the Indiana Harbor Canal. Although termed a river, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges.

A chapter entitled "Facility Setting And Physical Characteristics" has been presented in the CCR (Chapter 2). This chapter of the CCR provides additional detail regarding the physical characteristics of the East Chicago Facility.

1.2.4 Topography

Sections entitled "Regional Topography and Drainage" and "Site Topography and Drainage" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-2 through 2-4). These sections of the CCR provide information regarding the general topography of the East Chicago Facility property.

1.2.5 Local Hydrology and Hydrogeology

Sections entitled "Meterology and Surface Water Hydrology," "Hydrogeology," and "Regional Water Supply" have been presented in the CCR (Volume 1, Chapter 2, pg. 2-3 through 2-4 and pg. 2-6 through 2-9). These sections of the CCR provide information regarding the local hydrology and hydrogeology of the East Chicago Facility property and surrounding region.

1.3 Site History

1.3.1 General History

The facility was established in 1892 to manufacture inorganic chemicals by the Grasselli Corporation. DuPont operated the facility for Grasselli from 1927-1936. In 1936, the facility was formally deeded to DuPont, who has operated the facility since that time. The facility grew between 1893 and 1945, covering nearly 160 acres by 1930.

Manufacturing operations were limited to the western portion of the property (the eastern portion of the property was never developed). Over its 105-year lifetime, the East Chicago facility produced more than 100 products which include inorganic acids and chemicals (e.g., sulfuric, nitric, hydrochloric, phosphoric and fluorosulfonic

acids); various chloride, ammonia, and zinc products; inorganic agricultural chemicals; trichlorofluoromethane (TCFM) or Freon® products; and several organic herbicides and insecticides (e.g., hexazinone). Operations have significantly declined since the end of World War II. The facility now manufactures a colloidal silica product (Ludox®) and sodium silicate solution.

A chapter entitled "Facility Operations" has been presented in the CCR (Chapter 3). This chapter of the CCR provides additional detail regarding the historic operations, describes the waste management practices, and identifies the solid waste management units (SWMUs) and Areas of Concern (AOCs) of the East Chicago Facility.

With specific regard to the study area, the drainage network within the GCR basin has been severely disrupted since the late nineteenth century to provide for navigation, wastewater discharge, and site drainage. The GCR originally flowed from west to east; discharging into Lake Michigan near the present location of Marquette Park. Early in the twentieth century, the Indiana Harbor Canal was dredged, bisecting the GCR into the East and West Branches and creating a new outlet into Lake Michigan. The former mouth of the river became permanently closed by sand dunes, and the flow was reversed in the East Branch, with discharge to Lake Michigan through the Indiana Harbor Canal.

As previously noted, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges. The total volume of wastewater discharged into the East Branch is constantly changing as a result of alterations in industrial and municipal wastewater treatment. The wastewater discharge has been characterized as representing in excess of 90 percent of the present flow in the East Branch. Over 20 permitted industrial outfalls and one municipal outfall are currently located upstream of the East Chicago Facility. Additional detail regarding the East Branch of the GCR is provided in Sections 2.2 (Physical Setting) and 3.2 (Conceptual Model) of the SCS Work Plan.

1.3.2 Past Data Collection Activities

DuPont has conducted several environmental investigations of various media (soil, groundwater, river bank water) at the East Chicago Facility since 1983. These environmental investigations are described briefly in Table 4-1 of the CCR. The environmental media and constituent groups analyzed and the data quality level generated (primarily level IV) during these investigations are listed in Table 4-2 of the

CCR. The constituents detected in the various environmental media are summarized in Table 4-3 of the CCR. The primary constituents detected in environmental media at the facility were inorganic compounds, with the most frequent detections being the major ions (i.e., those ions which are prevalent in the environment and are primary components of rock, soil, and water [e.g., calcium, magnesium, sodium]), water quality parameters (e.g., nitrates), and metals. Organic compounds were rarely detected in environmental media at the facility. The frequency of detection and concentrations of these constituents in various environmental media is summarized in Tables 4-5 and 4-6, respectively, of the CCR. Although many of the detected constituents occur naturally in the environment, many were also components of products or waste streams at the facility, as summarized in Table 4-4 of the CCR.

A chapter entitled "Current Understanding of Environmental Quality Conditions" is presented in the CCR (Chapter 4). This chapter of the CCR provides an overview of the investigative activities conducted at the East Chicago Facility, summarizes available data quality data by medium and constituent groups, discusses data limitations, and describes the results of characterization work completed to date.

In addition, numerous environmental investigations of the GCR have been conducted by state and federal agencies, as well as other interested parties. Elevated concentrations of metals, oil and grease, and organic compounds (i.e., phenols, organochlorine pesticides, and volatile and semivolatile aromatic compounds) have been found in the sediments as discussed in "Grand Calumet River - Indiana Harbor Canal Sediment Cleanup and Restoration Alternatives Project," (Draft Report, US Army Corps of Engineers, Chicago District, Great Lakes and Ohio River Division, Chicago, IL, 1997) and in "Toxicity of Sediments and Sediment Pore Waters from the Grand Calumet River - Indiana Harbor, Indiana Area of Concern," (Hoke, R.A., J.P Giesy, M. Zabik, and M. Unger, 1993, Ecotoxicology and Environmental Safety 26:86-112). Fecal coliform bacteria, nutrients, metals, organic compounds, and conventional parameters have been routinely found in the surface water and are discussed in "Streamflow and Water Quality of the Grand Calumet River, Lake County, Indiana, and Cook County, Illinois, October 1984," (US Geological Survey, Water Resources Division, Indianapolis, IN, in cooperation with the Indiana State Board of Health, 1987, Water-Resources Investigation Report 86-4208). Information on sediments, surface water and sources, surface water hydrology and sediment transport, wetlands, and biological resources is summarized in Section 2.3 (Results of Initial Evaluation of Available Information) of the SCS Work Plan. Efforts will

continue to acquire and evaluate additional information from other sources throughout the SCS process, and this data will be presented in the Phase 1 SCS report.

In its Stage 1 Remedial Action Plan (RAP) for the Indiana Harbor Canal, GCR, and Nearshore Lake Michigan AOC, the IDEM (IDEM 1991) identified 14 beneficial uses that were either confirmed to be impaired or considered likely to be impaired. These beneficial uses are listed in Table 3-1 of the SCS Work Plan. Sediment contamination is considered to be a major cause of use impairments in most of the Great Lakes areas of concern. Enough information is known about the effects of environmental contaminants on biological organisms to link some of the alleged impaired uses with substances introduced to the environment. Table 3-2 of the SCS Work Plan summarizes known associations between alleged impairments, substances in the environment, and the environmental media of primary or secondary importance in the use impairment. The substances in the environment that are associated with various use impairments include metals, mercury, PCBs, chlorinated pesticides, dioxins and dioxin-like compounds, polycyclic aromatic hydrocarbons (PAHs), oil and grease, nutrients, grain size, other sediment conventional parameters, fecal coliform bacteria, and dissolved oxygen. Additional detail on the impaired beneficial uses is provided in Section 3.1 of the SCS Work Plan.

1.3.3 Current Status

The preliminary conceptual model of the GCR (Section 3.2 of the SCS Work Plan) provides the framework for understanding the conditions and processes affecting source loading, chemical distributions, and sediment dynamics. Ultimately, any selected restoration alternative should maximize the improvement in impaired uses, minimize the potential for recontamination of surface water and sediments, and minimize adverse effects on existing wetlands. The conditions and processes of greatest interest and related information needs are described in Tables 4-1, 4-2, and 4-3 of the SCS Work Plan.

1.4 Project Objectives

In its Stage 1 RAP, the IDEM (IDEM 1991) identified 14 beneficial uses that were either confirmed to be impaired or considered likely to be impaired for the AOC, as previously stated. Additional details on these 14 beneficial uses are provided in Section 3.1 of the SCS Work Plan. In order to understand the conditions and processes affecting source loading, constituent distributions, and sediment dynamics in the GCR in the vicinity of the East

Chicago Facility, a preliminary conceptual model was developed. Information to be collected throughout the SCS will be used to refine and further develop that conceptual model. Additional details on the preliminary conceptual model, which was developed to serve as the framework for understanding the key conditions and processes that affect the Constituents of Interest (COIs) in the larger GCR - Indiana Harbor Canal system, are provided in Section 3.2 of the SCS Work Plan. The way in which the processes are incorporated into the technical approach to the SCS is described in Section 4 of the SCS Work Plan.

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during SCS activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality.

1.4.1 Specific Objectives and Associated Tasks

The collection of information, either through field sampling and laboratory analyses or through the synthesis of data from sources, will be used to understand how contaminants in the GCR contribute to the alleged impaired uses and identify the potential source(s) of those contaminants.

The specific objectives of the data collection presented in Section 5.3 of the SCS Work Plan are as follows:

- Surface sediment (0 to 10 cm, considered the biologically active zone) sampling and analysis will be conducted to determine the chemical and physical properties of sediment to which human and ecological receptors may be exposed, investigate the distribution of constituents of interest (COIs) in sediments, identify any ongoing sources of COIs at the East Chicago Facility, and determine if ongoing sources upstream of DuPont are providing COIs to surface sediments in the study area. Select surface sediment samples will be analyzed for benzene/ethybenzene/toluene/ total xylenes (BTEX), PAHs and phenols, organochlorine pesticides and PCBs, metals, acid volatile sulfides (AVS), simultaneously extracted metals (SEM), oil and grease, soluble fluoride, phenolics, pH, total organic carbon (TOC), total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, total kjeldahl nitrogen (TKN), and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the surface sediment sampling and analysis is provided in Section 5.3.2.1 of the SCS Work Plan.

- Near-surface sediment (10-20 cm and 20-30 cm) sampling and analysis will be conducted to determine the chemical properties of sediments that could be exposed if sediment were eroded or scoured and the degree of natural recovery that has occurred as industrial and municipal sources on the East Branch have been controlled in recent years. Select near-surface sediment samples will be analyzed for BTEX, PAHs and phenols, organochlorine pesticides and PCBs, metals, AVS, SEM, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, TKN, and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the near-surface sediment sampling and analysis is provided in Section 5.3.2.2 of the SCS Work Plan.

- Deep sediment core sampling and analysis will be conducted to determine the chemical and physical properties of historically deposited sediments and associated industrial and municipal releases and to assess the potential for chemicals associated with buried sediment to migrate to surface sediments or surface water. Select deep sediment core samples will be analyzed for metals, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, TKN, and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the deep sediment core sampling and analysis is provided in Section 5.3.2.3 of the SCS Work Plan.

- Wetlands surface sediment sampling and analysis will be conducted to determine if constituents potentially associated with DuPont discharges could have impacted the wetlands. Select wetlands sediment samples will be analyzed for the herbicide compound 2,4-D, metals, AVS, SEM, oil and grease, soluble fluoride, phenolics, pH, TOC, total solids, grain size, total cyanide, total sulfide, soluble sulfate, ammonia nitrogen, TKN, and/or total phosphorus as defined in Table F1-1. Additional detail on the rationale for the wetlands sediment sampling and analysis is provided in Section 5.3.2.4 of the SCS Work Plan.

- Surface water sampling and analysis will be conducted to determine the concentrations of selected COIs in the vicinity of the East Chicago Facility, to determine the trophic state of the East Branch and its potential effect on plant and animal life, to provide an indication of the loading of COIs to the study area from upstream sources, and to determine the effect of rainfall events on overall water quality. Select surface water samples will be analyzed for total and dissolved metals, COD, BOD, fecal coliform bacteria, oil and grease, phenolics, ammonia

nitrogen, nitrate/nitrite nitrogen, TKN, orthophosphate, total phosphorus, TSS, and/or hardness as defined in Table F1-2. Furthermore, field parameters (pH, conductivity, temperature, and dissolved oxygen) will be measured periodically throughout sampling. Additional detail on the rationale for the surface water sampling and analysis is provided in Section 5.3.3 of the SCS Work Plan.

- Source loading evaluation will be performed to determine the magnitude of ongoing source loading, its potential effect on COI concentrations in surface water and sediment of the East Branch, and the need to further control sources prior to evaluation of potential remedial alternatives. The net loading to the river in the vicinity of the East Chicago Facility will be evaluated from the surface water sampling data previously mentioned. Additional detail on the rationale for the source loading evaluation is provided in Section 5.3.4 of the SCS Work Plan.

- Surface water hydrology and sediment dynamics will be assessed to determine the potential for erosion and downstream transport of surface sediments, exposure of underlying sediments, and the relative contribution of point source particulate loading and surface sediment resuspension to sediment loading into the Indiana Harbor Canal by the GCR. This evaluation will be conducted in close coordination with ongoing efforts of the US Army Corps of Engineers. The grain size data collected as part of the sediment sampling task will be used in the bed erosion and deposition predictions. Observations concerning the general cohesiveness of the sediments will also be made in the field. In addition, flow measurements will be made in conjunction with the surface water sampling task and continuous measurements of water surface elevations will be made at each end of the study area. Additional detail on the rationale for the surface water hydrology and sediment dynamics assessment is provided in Section 5.3.5 of the SCS Work Plan.

In order to accomplish these goals, a confirmational level of analytical quality is needed. This provides the highest level of data quality and may be used for purposes including, but not limited to, risk assessment, evaluation of remedial alternatives, and establishing cleanup levels. These analyses require full documentation of SW-846 analytical methods, sample preparation steps, data packages, and data validation procedures necessary to provide defensible data. Quality Control must be sufficient to define the precision and accuracy of these procedures at every step.

Additional aliquots of the surface and near-surface sediment samples not designated for the organic analyses PAHs, phenols, pesticides, and PCBs as well as deep sediment

cores and wetland sediment samples will be collected for possible future analysis for PAHs, phenols, pesticides, and PCBs as defined in Table F1-1. These samples will be archived in frozen condition at the laboratory until such time that it is decided to analyze them. The results of these possible sample analyses will be used for additional informational purposes, and these samples will not be subject to many of the requirements presented in this QAPP.

If, upon evaluation, the data generated during the Phase I SCS is not found to meet the project objectives previously described, DuPont will include any recommendations for additional data collection in the Phase I SCS report. If, after consultation with the US EPA Region 5 and the IDEM, it is decided that a subsequent SCS phase is required, it will be described in an amendment the SCS Work Plan (inclusive of this QAPP). Any subsequent SCS phase will begin subject to approval of these amendments by the US EPA Region 5.

1.4.2 Project Target Parameters and Intended Data Usages

The list of collective target parameters for the sediment and surface water matrices for this project is included in Tables F1-1 and F1-2, respectively. The rationale for the target parameters is presented in Table 5-1 of the SCS Work Plan. Intended data use is to screen for levels of target parameters that may pose a current or potential threat to human health or the environment. The data shall be compared to the "Ecological Data Quality Levels RCRA Appendix IX Hazardous Constituents US Environmental Protection Agency, Region 5," however, as acknowledged in this document, some of these ecological data quality levels (EDQLs) are below method reporting limits (MRLs).

During the analytical design of the Phase I SCS and the preparation of this QAPP, the laboratory's practical quantitation limits (PQLs) and method detection limits (MDLs) were compared to the EDQLs, where available. The PQLs/MDLs and EDQLs for the sediment and surface water matrices are presented in Tables F1-1 and F1-2, respectively. It is notable that many of the PQLs and, in some cases also the MDLs, are higher than the EDQLs for a number of the parameters listed in Tables F1-1 and F1-2. The ability to meet the EDQLs without compromising the use of analytical methodologies which represent the best available technology was also evaluated during the analytical design of the Phase I SCS. For the purposes of this evaluation, the best technology was defined as the analytical methodology which will achieve the lowest PQLs without compromising the high qualitative accuracy necessary for site

characterization. For this project, the choice of the best technology also took into consideration the site-specific features and complex matrices (i.e., high oil and grease) of the sediments and surface water of the GCR.

As previously stated, although termed a river, the East Branch of the GCR is primarily a conveyance for industrial and municipal wastewater discharges. Previous environmental investigations have found elevated concentrations of numerous parameters, including extremely high levels of oil and grease. The extremely high levels of oil and grease will mostly hinder the performance of chromatography methods, although other analyses may also be impacted by interference from these constituents. Therefore, the techniques with the highest qualitative accuracy have been chosen for the Phase I SCS (i.e., GC/MS methodologies have been chosen over GC and HPLC methodologies wherever possible). In addition, sample clean-ups will be performed at the discretion of the laboratory analysts whenever it is believed that the cleanups may enhance the sample analysis.

1.4.2.1 Field Parameters

The intended field parameters are pH, temperature, specific conductivity, and dissolved oxygen in the surface water.

1.4.2.2 Laboratory Parameters

The intended laboratory parameters for sediment and surface water samples are listed in Tables F1-1 and F1-2, respectively. Surface water samples will be collected and analyzed for both total and dissolved metals for the targeted metals listed in Table F1-2.

1.4.3 Data Quality Objectives

The intended data quality objectives (DQOs) for precision, accuracy, representativeness, comparability, and completeness for project data are discussed in Section 3 of this QAPP for all samples except the archived samples and are summarized in Attachment F1 to this QAPP. The intended DQO for sensitivity is to meet the PQLs for parameters where the PQL is less than or equal to the EDQL and to meet MDLs for all other parameters. The sensitivity DQO for constituents that have no EDQL will be to meet the MDL. The PQLs and MDLs are summarized in Tables F1-1 and F1-2. Error in quantitation increases as concentrations approach the MDLs.

Therefore, positive results between the MDL and PQL will be reported as quantitative estimates.

1.5 Sample Network Design and Rationale

The sample network design and rationale for sample locations (in respective media) is fully described in detail in Section 5.3 (Task 2 Sediment Characterization Area Investigation) of the SCS Work Plan. Maps which show the sample locations are provided in Figures B-1 and B-2 of the FSP, which has been included as Appendix B to the SCS Work Plan.

1.5.1 Sample Network by Task and Matrix

Sample matrices, analytical parameters, and frequencies of sample collection can be found in Sections 2.2 (Sediment Sampling), 2.3 (Surface Water Sampling), and 2.5 (Wetlands Evaluation) of the FSP, which has been included as Appendix B to the SCS Work Plan.

1.5.2 Site Maps of Sampling Locations

Maps showing intended soil, sediment and surface water sampling locations are included as Figures in the FSP, which has been included as Appendix B to the SCS Work Plan. It is possible, however, that, depending on the nature of encountered field conditions, some of these locations will be changed. Potential modifications to sample locations will be communicated to the US EPA RCRA Project Coordinator in a timely fashion so as to not jeopardize the project schedule.

1.5.3 Rationale of Selected Sampling Locations

The rationale for why the selected sampling locations (and depths) were chosen is fully described in detail in Section 5.3 (Task 2 Sediment Characterization Area Investigation) of the SCS Work Plan.

1.5.4 Sample Network Summary Table

The sample network for this project is presented in tabular format in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the SCS Work Plan.

1.6 Project Schedule

1.6.1 Anticipated Date of Project Mobilization

Mobilization of project resources will be initiated within 30 days of receiving SCS Work Plan and QAPP approval from the US EPA Region 5. It is anticipated that field activities will require 3 months to complete. A draft schedule is included as Figure 5-3 of the SCS Work Plan.

1.6.2 Task Bar Chart and Associated Timeframes

The dates of projected milestones are indicated in Figure 5-3 of the SCS Work Plan.

TABLE F1-1: PROJECT TARGET PARAMETERS IN SEDIMENT

CAS# (1)	Analyte Name	Analysis Method (2)	SEDIMENT EDQL (3)	SEDIMENT PQL (4)	SEDIMENT MDL (5)	SEDIMENT UNITS	AQUEOUS BLANK PQL	AQUEOUS BLANK MDL	AQUEOUS BLANK UNITS
BTEX									
71-43-2	Benzene	SW-846 8260B	142	5	1	ug/Kg	5	1	ug/L
100-41-4	Ethylbenzene	SW-846 8260B	0.1	5	1	ug/Kg	5	2	ug/L
108-88-3	Toluene	SW-846 8260B	52,500	5	1	ug/Kg	5	2	ug/L
1330-20-7	Xylenes (total)	SW-846 8260B	1,880	5	1	ug/Kg	5	1	ug/L
Polycyclic Aromatic Hydrocarbons (PAHs) and Phenols									
83-32-9	Acenaphthene	SW-846 8270C	6.71	330	33	ug/Kg	10	1	ug/L
208-96-8	Acenaphthylene	SW-846 8270C	5.87	330	33	ug/Kg	10	2	ug/L
120-12-7	Anthracene	SW-846 8270C	46.9	330	33	ug/Kg	10	1	ug/L
56-55-3	Benzo[a]anthracene	SW-846 8270C	31.7	330	33	ug/Kg	10	1	ug/L
205-99-2	Benzo[b]fluoranthene	SW-846 8270C	1,040	330	33	ug/Kg	10	2	ug/L
207-08-9	Benzo[k]fluoranthene	SW-846 8270C	240	330	33	ug/Kg	10	1	ug/L
191-24-2	Benzo[ghi]perylene	SW-846 8270C	170	330	33	ug/Kg	10	1	ug/L
50-32-8	Benzo[a]pyrene	SW-846 8270C	31.9	330	33	ug/Kg	10	1	ug/L
59-50-7	4-Chloro-3-methylphenol	SW-846 8270C	11	330	33	ug/Kg	10	1	ug/L
95-57-8	2-Chlorophenol	SW-846 8270C	12	330	33	ug/Kg	10	1	ug/L
218-01-9	Chrysene	SW-846 8270C	57.1	330	33	ug/Kg	10	1	ug/L
132-64-9	Dibenzofuran	SW-846 8270C	1,520	330	33	ug/Kg	10	1	ug/L
53-70-3	Dibenz[a,h]anthracene	SW-846 8270C	6.22	330	33	ug/Kg	10	2	ug/L
120-83-2	2,4-Dichlorophenol	SW-846 8270C	134	330	33	ug/Kg	10	1	ug/L
105-67-9	2,4-Dimethylphenol	SW-846 8270C	305	330	33	ug/Kg	10	1	ug/L
534-52-1	4,6-Dinitro-2-methylphenol	SW-846 8270C	10	830	170	ug/Kg	25	5	ug/L
51-28-5	2,4-Dinitrophenol	SW-846 8270C	1	830	170	ug/Kg	25	5	ug/L
206-44-0	Fluoranthene	SW-846 8270C	111.3	330	33	ug/Kg	10	1	ug/L
86-73-7	Fluorene	SW-846 8270C	21.2	330	33	ug/Kg	10	1	ug/L
193-39-5	Indeno[1,2,3-cd]pyrene	SW-846 8270C	200	330	33	ug/Kg	10	1	ug/L
78-59-1	Isophorone	SW-846 8270C	422	330	33	ug/Kg	10	1	ug/L
91-57-6	2-Methylnaphthalene	SW-846 8270C	20.2	330	33	ug/Kg	10	1	ug/L
95-48-7	2-Methylphenol	SW-846 8270C	0.826	330	33	ug/Kg	10	1	ug/L
65794969	3 or 4-Methylphenol	SW-846 8270C	0.808	330	67	ug/Kg	10	3	ug/L
91-20-3	Naphthalene	SW-846 8270C	34.6	330	33	ug/Kg	10	1	ug/L
88-75-5	2-Nitrophenol	SW-846 8270C	8	330	33	ug/Kg	10	1	ug/L
100-02-7	4-Nitrophenol	SW-846 8270C	8	830	170	ug/Kg	25	5	ug/L
87-86-5	Pentachlorophenol	SW-846 8270C	30,200	830	170	ug/Kg	25	5	ug/L
85-01-8	Phenanthrene	SW-846 8270C	41.9	330	33	ug/Kg	10	2	ug/L
108-95-2	Phenol	SW-846 8270C	27	330	67	ug/Kg	10	1	ug/L
129-00-0	Pyrene	SW-846 8270C	53	330	33	ug/Kg	10	1	ug/L
95-95-4	2,4,5-Trichlorophenol	SW-846 8270C	5,390	330	33	ug/Kg	10	1	ug/L
88-06-2	2,4,6-Trichlorophenol	SW-846 8270C	85	330	33	ug/Kg	10	2	ug/L
Organochlorine Pesticides									
309-00-2	Aldrin	SW-846 8081A	2	0.33	0.08	ug/Kg	0.01	0.002	ug/L
319-84-6	*alpha*-BHC	SW-846 8081A	6	0.33	0.15	ug/Kg	0.01	0.003	ug/L
319-85-7	*beta*-BHC	SW-846 8081A	5	0.33	0.32	ug/Kg	0.01	0.003	ug/L
319-86-8	*delta*-BHC	SW-846 8081A	71,500	0.33	0.17	ug/Kg	0.01	0.003	ug/L
58-89-9	*gamma*-BHC/Lindane	SW-846 8081A	0.94	0.33	0.09	ug/Kg	0.01	0.002	ug/L
72-54-8	4,4'-DDD	SW-846 8081A	5,030	0.67	0.44	ug/Kg	0.01	0.004	ug/L
72-55-9	4,4'-DDE	SW-846 8081A	1.42	0.67	0.51	ug/Kg	0.01	0.005	ug/L
50-29-3	4,4'-DDT	SW-846 8081A	1.19	0.67	0.51	ug/Kg	0.01	0.008	ug/L
60-57-1	Dieldrin	SW-846 8081A	2	0.67	0.13	ug/Kg	0.02	0.004	ug/L
959-98-8	Endosulfan I	SW-846 8081A	0.175	0.33	0.23	ug/Kg	0.01	0.002	ug/L
33213-65-9	Endosulfan II	SW-846 8081A	0.104	0.67	0.39	ug/Kg	0.02	0.01	ug/L
1031-07-8	Endosulfan sulfate	SW-846 8081A	35	0.67	0.27	ug/Kg	0.02	0.012	ug/L
72-20-8	Endrin	SW-846 8081A	2.67	0.67	0.23	ug/Kg	0.02	0.008	ug/L
7421-93-4	Endrin aldehyde	SW-846 8081A	3,200	0.67	0.16	ug/Kg	0.02	0.012	ug/L
76-44-8	Heptachlor	SW-846 8081A	0.6	0.33	0.23	ug/Kg	0.01	0.003	ug/L
1024-57-3	Heptachlor epoxide	SW-846 8081A	0.6	0.33	0.06	ug/Kg	0.01	0.002	ug/L
72-43-5	Methoxychlor	SW-846 8081A	4	3.3	2.34	ug/Kg	0.1	0.04	ug/L
8001-35-2	Toxaphene	SW-846 8081A	0.109	33	7	ug/Kg	1.0	0.2	ug/L
5103-71-9	*alpha*-Chlordane	SW-846 8081A	4.5 (6)	0.33	0.067	ug/Kg	0.01	0.002	ug/L
5103-74-2	*gamma*-Chlordane	SW-846 8081A	4.5 (6)	0.33	0.067	ug/Kg	0.01	0.002	ug/L

TABLE F1-1: PROJECT TARGET PARAMETERS IN SEDIMENT

CAS# (1)	Analyte Name	Analysis Method (2)	SEDIMENT EDQL (3)	SEDIMENT PQL (4)	SEDIMENT MDL (5)	SEDIMENT UNITS	AQUEOUS BLANK PQL	AQUEOUS BLANK MDL	AQUEOUS BLANK UNITS
PCBs									
12674-11-2	Aroclor-1016	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
11104-28-2	Aroclor-1221	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.3	ug/L
11141-16-5	Aroclor-1232	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
53469-21-9	Aroclor-1242	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.2	ug/L
12672-29-6	Aroclor-1248	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.1	ug/L
11097-69-1	Aroclor-1254	SW-846 8082	34.1 (7)	17	3.6	ug/Kg	0.5	0.1	ug/L
11096-82-5	Aroclor-1260	SW-846 8082	34.1 (7)	17	3.3	ug/Kg	0.5	0.1	ug/L
Organochlorine Herbicides									
94-75-7	2,4-D	SW-846 8151A	6	17	5.5	ug/Kg	0.5	0.1	ug/L
Metals									
7440-36-0	Antimony	SW-846 6010B	NA	1.0	0.38	mg/Kg	10	4.1	ug/L
7440-38-2	Arsenic	SW-846 6010B	5.9	1.0	0.38	mg/Kg	10	5.0	ug/L
7440-38-2	Arsenic	SW-846 7060A	5.9	2.0	0.086	mg/Kg	10	2.0	ug/L
7440-43-9	Cadmium	SW-846 6010B	0.596	0.10	0.039	mg/Kg	1.5	0.42	ug/L
7440-47-3	Chromium	SW-846 6010B	26	0.50	0.18	mg/Kg	3.0	1.3	ug/L
7440-50-8	Copper	SW-846 6010B	16	0.50	0.13	mg/Kg	4.0	1.4	ug/L
7439-92-1	Lead	SW-846 6010B	31.0	1.0	0.40	mg/Kg	5.0	3.4	ug/L
7439-92-1	Lead	SW-846 7421	31.0	1.0	0.15	mg/Kg	3.0	1.1	ug/L
7439-95-4	Magnesium	SW-846 6010B	NA	5.0	1.6	mg/Kg	50	16	ug/L
7439-97-6	Mercury	SW-846 7470A/7471A	0.174	0.10	0.0028	mg/Kg	0.20	0.020	ug/L
7439-98-7	Molybdenum	SW-846 6010B	NA	5	1.1	mg/Kg	0.05	0.012	ug/L
7440-02-0	Nickel	SW-846 6010B	16	0.60	0.11	mg/Kg	5.0	1.6	ug/L
7440-22-4	Silver	SW-846 6010B	0.5	0.2	0.077	mg/Kg	2.0	0.81	ug/L
7440-62-2	Vanadium	SW-846 6010B	NA	0.20	0.062	mg/Kg	2.0	0.99	ug/L
7440-66-6	Zinc	SW-846 6010B	120	3.0	0.48	mg/Kg	20	0.49	ug/L
Simultaneously Extracted Metals									
7440-38-2	Arsenic	SW-846 6010B/7000A	NA	0.04	0.007	umole/g	0.04	0.007	umole/g
7440-43-9	Cadmium	SW-846 6010B/7000A	NA	0.005	0.004	umole/g	0.005	0.004	umole/g
7440-47-3	Chromium	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7440-50-8	Copper	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7439-92-1	Lead	SW-846 6010B/7000A	NA	0.02	0.003	umole/g	0.02	0.003	umole/g
7439-97-6	Mercury	SW846-7470A	NA	0.0002	0.000004	umole/g	0.0002	0.000004	umole/g
7440-02-0	Nickel	SW846-6010B	NA	0.02	0.004	umole/g	0.02	0.004	umole/g
7440-66-6	Zinc	SW846-6010B	NA	0.04	0.005	umole/g	0.04	0.005	umole/g
Wet Chemistry									
(8)	Grain Size	ASTM D422-63	NA	NA	NA	%	NA	NA	NA
7723-14-0	Total Phosphorus	EPA 365.1	NA	12.5	10	mg/Kg	0.05	0.04	mg/L
EVS-0162	Acid Volatile Sulfides	SW-846 9030B	NA	1	0.2	umole/g	1	0.2	umole/L
7664-41-7	Ammonia Nitrogen	EPA 350.1	NA	20	5.2	mg/Kg	0.10	0.03	mg/L
57125	Cyanide, Total	SW846 9012A	0.1	0.125	0.1	mg/Kg	0.005	0.004	mg/L
16984-48-8	Soluble Fluoride	SW-846 9056	NA	1	0.8	mg/Kg	0.1	0.08	mg/L
C-007	Oil & Grease	SW-846 9071A	NA	2000	600	mg/Kg	2.5	8	mg/L
C-006	pH	SW-846 9045C	NA	NA	NA	SU	NA	NA	SU
C-008	Total Solids	EPA 160.3	NA	0.50	0.10	%	NA	NA	NA
C-020	Phenolics	SW-846 9065	NA	0.1	0.25	mg/Kg	0.01	0.004	mg/L
C-021	Total Kjeldahl Nitrogen	EPA 351.2	NA	500	175	mg/Kg	2.0	0.70	mg/L
C-012	Total Organic Carbon	EPA 415.1	NA	50	10	mg/Kg	1.0	0.3	mg/L
18496-25-8	Total Sulfide	SW-846 9030B	NA	20	5.46	mg/Kg	2	0.56	mg/L
14808-79-8	Soluble Sulfate	SW-846 9056	NA	10	3	mg/Kg	1.0	0.30	mg/L

NOTES:

(1) Fictitious CAS number created to represent the coeluting isomers 3-methylphenol and 4-methylphenol. Also, fictitious CAS number assigned to wet chemistry parameters since an actual CAS # does not exist.

(2) SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," Third Edition (with Updates).
EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020.

(3) EDQL = Ecological Data Quality Level

(4) PQL = Practical Quantitation Limit. Sample-specific quantitation limits are highly matrix-dependent. The PQLs listed may not always be achievable. Sample-specific PQLs will be adjusted for % solids and volumes and dilutions which vary from standard procedures.

(5) MDL = Method Detection Limit. Sample-specific detection limits are highly matrix-dependent. The MDLs listed may not always be achievable. Sample-specific MDLs will be adjusted for % solids and volumes and dilutions which vary from standard procedures.

(6) EDQL presented is actually the EDQL for technical chlordane

(7) EDQL presented is actually the EDQL for total polychorinated biphenyls

(8) Grain size will be reported by the percent in a certain mm sized sieve. Therefore, a CAS # is not applicable to grain size.

TABLE F1-2: PROJECT TARGET PARAMETERS IN SURFACE WATER

CAS# (1)	Analyte Name	Analysis Method (2)	SURFACE WATER EDQL (3)	PQL (4)	MDL (5)	UNITS
Select Metals	(Total and Dissolved)					
7440-36-0	Antimony	SW-846 6010B	30	10	4.1	ug/L
7440-38-2	Arsenic	SW-846 6010B	53	10	5.0	ug/L
7440-38-2	Arsenic	SW-846 7060A	53	10	2.0	ug/L
7440-43-9	Cadmium	SW-846 6010B	0.0216	1.5	0.42	ug/L
7440-47-3	Chromium	SW-846 6010B	11	3.0	1.3	ug/L
7440-50-8	Copper	SW-846 6010B	2.14	4.0	1.4	ug/L
7439-92-1	Lead	SW-846 6010B	1.30	5.0	3.4	ug/L
7439-92-1	Lead	SW-846 7421	1.30	3.0	1.1	ug/L
7439-97-6	Mercury	SW-846 7470A	0.000974	0.20	0.020	ug/L
7440-02-0	Nickel	SW-846 6010B	36.8	5.0	1.6	ug/L
7440-66-6	Zinc	SW-846 6010B	27.6	20	4.9	ug/L
Wet Chemistry						
7664-41-7	Ammonia Nitrogen	EPA 350.1	NA	0.10	0.03	mg/L
C-002	Biochemical Oxygen Demand	EPA 405.1	NA	2.0	0.9	mg/L
C-004	Chemical Oxygen Demand	EPA 410.4	NA	50	8.95	mg/L
U-004	Fecal Coliform	SM 9221C	NA	NA	NA	colonies/100mL
471341	Hardness	EPA 130.2	NA	3.0	0.68	mg/L
C-005	Nitrate/Nitrite Nitrogen	SW-846 9056	NA	0.1	0.08	mg/L
C-007	Oil & Grease	SW-846 9071A	NA	8.0	2.5	mg/L
14265-44-2	Orthophosphate	EPA 365.3	NA	0.02	0.02	mg/L
C-021	Total Kjeldahl Nitrogen	EPA 351.2	NA	2.0	0.70	mg/L
7723-14-0	Total Phosphorus	EPA 365.2	NA	0.05	0.04	mg/L
C-020	Phenolics	SW-846 9066	NA	0.01	0.004	mg/L
C-009	Total Suspended Solids	EPA 160.2	NA	9.0	2.6	mg/L

NOTES:

(1) Fictitious CAS # assigned to Wet Chemistry parameter since an actual CAS # does not exist.

(2) SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," Third Edition.
EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020.
SM - "Standard Methods for the Examination of Water and Wastewater," (19th Edition, 1995).

(3) EDQL= Ecological Data Quality Level

(4) PQL = Practical Quantitation Limit. Sample-specific quantitation limits are highly matrix-dependent. The PQLs listed may not always be achievable. Sample-specific PQLs will be adjusted for volumes and dilutions which vary from standard procedures.

(5) MDL = Method Detection Limit. Sample-specific detection limits are highly matrix-dependent. The MDLs listed may not always be achievable. Sample-specific MDLs will be adjusted for volumes and dilutions which vary from standard procedures.

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the US EPA RCRA Project Coordinator (RPC), the DuPont Corporate Remediation Group (CRG) has overall responsibility for all phases of the SCS. All project management will be provided by DuPont CRG. DuPont will direct the field investigation, the laboratory analyses, and the data validation and will prepare the SCS report. The various quality assurance, field, laboratory, and management responsibilities of key project personnel are defined below. Environmental Standards, Inc. (Environmental Standards) of Valley Forge, Pennsylvania, will provide the quality assurance support for the project which will include the preparation of the QAPP and independent validation of data. Lancaster Laboratories of Lancaster, Pennsylvania, will provide the majority of the laboratory services for the SCS. In addition, National Environmental Testing, Inc. (NET) of Bartlett, Illinois, will provide laboratory services for several wet chemistry analyses with short holding times. The exact addresses of the project laboratories, as well as the analyses that each laboratory will be performing, have been provided in Section 7 of this QAPP. **The US EPA Region 5 will be notified in writing when a contractor has been chosen to serve as the field technical staff for this project.**

2.1 Project Organization Chart

The lines of authority for this specific project can be found in Figure F2-1. This chart includes all individuals discussed below.

2.2 Management Responsibilities

2.2.1 US EPA RCRA Project Coordinator

The US EPA RCRA Project Coordinator (RPC), Mr. Allen Wojtas, has the overall responsibility for all phases of the SCS.

2.2.2 DuPont CRG Project Coordinators

The DuPont CRG Project Coordinators, Mr. Hilton Frey and Mr. Frank Smith, are responsible for implementing the project. The DuPont CRG Project Coordinators' primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The DuPont CRG Project Coordinators will report directly to the US EPA Region 5 RPC and will provide the major point of contact and control for matters concerning the project. The DuPont CRG Project Coordinators will:

- Define project objectives and develop a detailed work plan schedule;
- Maintain clear lines of communication between project team members; and
- Approve all reports (deliverables) before their submission to US EPA Region 5.

2.2.3 DuPont CRG Project Manager

The DuPont CRG Project Manager, Mr. David Epps, is responsible for implementing the project and has the responsibility to commit the resources necessary to meet project objectives and requirements. He has overall responsibility for ensuring that the project meets US EPA's objectives and DuPont's quality standards. The DuPont CRG Project Manager will report directly to the DuPont CRG Project Coordinators and is responsible for technical quality control and project oversight. The DuPont CRG Project Manager will:

- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Orient all field leaders and support staff concerning the project's special considerations;
- Monitor and direct the Field Team Leader;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;

- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Prepare the bimonthly progress reports; and
- Ultimately be responsible for the preparation and quality of interim and final reports.

2.2.4 DuPont CRG Community Relations Specialist

The DuPont CRG Community Relations Specialist, Mr. Charles Bussey, is responsible for all community relations activities, including representing the project team at meetings and public hearings. He will report directly to the DuPont CRG Project Manager.

2.3 Quality Assurance Responsibilities

2.3.1 DuPont CRG QA Manager

The DuPont CRG QA Manager, Dr. Harry Gearhart, will have direct access to DuPont CRG project management staff as necessary, to resolve any QA dispute. The DuPont CRG QA Manager will provide assistance to the DuPont CRG Project Manager in terms of overseeing the writing and distribution of the QAPP to all those parties connected with the project (including the laboratory). The DuPont CRG QA Manager will be responsible for the reviewing and approving of the QAPP. He will also provide assistance to the DuPont CRG Project QA Manager in resolving any laboratory issue.

2.3.2 DuPont CRG Project QA Manager

The DuPont CRG Project QA Manager, Ms. Kim Johnson, reports directly to the DuPont CRG QA Manager. She will have primary responsibility for monitoring laboratory performance and assuring compliance with the QA/QC procedures set forth in the QAPP. She is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, DuPont's policies, and US EPA requirements. Specific functions and duties include:

- Providing QA technical assistance to project staff; and
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the DuPont CRG Project Manager.

2.3.3 Environmental Standards QA Manager

The Environmental Standards QA Manager, Mr. David Blye, reports directly to the DuPont CRG Project QA Manager and will be responsible for ensuring that all DuPont procedures for this project are being followed. In addition, the Environmental Standards QA Manager will be responsible for the coordination of the QAPP preparation and the data validation of sample results from the analytical laboratory. Specific functions and duties include:

- Committing the necessary Environmental Standards resources to perform the QAPP preparation and data validation functions;
- Providing QA technical assistance to project staff;
- Approving Environmental Standards' project deliverables;
- Managing the project budget; and
- Overseeing the data reduction and generation of data validation reports.

2.3.4 Environmental Standards Data Validation Task Manager

The Environmental Standards Data Validation Task Manager, Ms. Meg Clark, will be responsible for preparing the QAPP. She will also be responsible for directing the validation of the analytical data collected for the investigation to determine data quality and for defining data usability. She will report directly to the Environmental Standards QA Manager. Specific responsibilities include:

- Reviewing all documents with respect to adherence of QA procedures provided in the QAPP;
- Performing and overseeing data validation for analytical data generated for the sediment samples collected for the SCS;
- Directing preparation of the quality assurance reviews for delivery to DuPont; and
- Communicating analytical deficiencies found during analysis or data validation to the DuPont CRG Project QA Manager to initiate corrective action.

2.4 US EPA Region 5 Quality Assurance Manager (RQAM)

The US EPA RQAM, Mr. Brian Freeman, has the responsibility to review and approve all Quality Assurance Project Plans (QAPPs). Additional US EPA responsibilities for the project include:

- Conducting external Performance and System Audits of SCS Laboratories; and
- Reviewing and evaluating analytical field and laboratory procedures

2.5 Laboratory Responsibilities

2.5.1 Laboratory Project Managers

The Lancaster Laboratories Project Manager, Ms. Nancy Bornholm, and the NET Project Manager, Ms. Mary Pearson, will report directly to the DuPont CRG Project QA Manager and will be responsible for the following at each of their respective laboratories:

- Monitoring analytical and QA project requirements;
- Assisting in the interpretation of this QAPP;
- Defining the laboratory QA procedures as appropriate for DuPont with the in-house QA Officer;
- Informing the DuPont CRG Project QA Manager of project status;
- Monitoring, reviewing, and evaluating the progress and performance of the project, thereby ensuring all resources of the laboratory are available on an as-required basis;
- Reviewing data packages for completeness of and compliance to project needs; and
- Overviewing final analytical reports.

2.5.2 Laboratory Operations Managers

The Lancaster Laboratories Operations Manager, Mr. Timothy Oostdyk, and the NET Operations Manager, Mr. Jean-Pierre Rouanet, will report to the laboratory Project Managers and, at each of their respective laboratories, will be responsible for:

- Supervising daily activities of the operational groups and QC activities performed as part of routine analytical operations;
- Coordinating laboratory analyses;

- Supervising in-house chain-of-custody;
- Scheduling sample analyses;
- Overseeing data review; and
- Overseeing preparation of analytical reports.

2.5.3 Laboratory Quality Assurance Officers

The Lancaster Laboratories QA Officer, Ms. Kathleen Loewen, and the NET QA Officer, Mr. Eric Yeggy, have the overall responsibility for data after it leaves each of their respective laboratories. The laboratory QA Officers will be independent of the laboratory but will communicate data issues through the laboratory Project Managers. In addition, the laboratory QA Officers will:

- Overview laboratory quality assurance;
- Overview QA/QC documentation;
- Conduct detailed data review;
- Determine whether to implement laboratory corrective actions, if required;
- With the associated laboratory Project Managers, define laboratory QA procedures as appropriate for DuPont;
- Oversee the preparation of the laboratory Standard Operation Procedures; and
- Sign the title page of the QAPP.

2.5.4 Laboratory Sample Custodians

Sample Custodians will report to their laboratory's Operations Managers. Due to the large size of Lancaster Laboratories, no one person performs all the duties of a Sample Custodian. The Lancaster Laboratories Sample Administration Group acts as an organized sample custodian team. At NET, Ms. Candra Long will be the Sample Custodian. Responsibilities of the Sample Custodians will include:

- Receiving and inspecting the incoming sample containers;
- Recording the condition of the incoming sample containers and reporting anomalies to the laboratory Project Managers;
- Signing appropriate documents;
- Verifying Chain-of-Custody and its correctness;
- Maintaining Chain-of-Custody;
- Notifying laboratory Project Managers and laboratory Operations Managers of sample receipt and inspection;
- Assigning a unique identification number and customer number, and entering each into the laboratory information management system (LIMS);
- With the help of the laboratory Operations Manager, initiating transfer of the samples to appropriate laboratory sections; and
- Controlling and monitoring access/storage of samples and extracts.

Final responsibility for project quality rests with the DuPont CRG Project Manager. Independent quality assurance will be provided by the laboratory Project Managers and QA Officers prior to release of all data to DuPont.

2.5.5 Laboratory Technical Staff

The Lancaster Laboratories and NET technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to each laboratory's Operations Manager.

2.6 Field Responsibilities

2.6.1 Field Team Leader

The DuPont CRG Project Manager will be supported by the Field Team Leader, **[To-Be-Determined]**. The Field Team Leader is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The Field Team Leader will be accountable for all field sampling and associated documentation procedures. The Field Team Leader is a highly experienced environmental professional and will report directly to the DuPont CRG Project Manager. Specific Field Team Leader responsibilities include:

- Provision of day-to-day coordination with the DuPont CRG Project Manager on technical issues in specific areas of expertise;
- Implementing of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Providing QA audit of the field operations;
- Coordinating and managing of field staff during sampling activities;
- Implementing of QC for technical data provided by the field staff including field measurement data;
- Ensuring that all field QC samples are properly collected, labeled, and shipped in the appropriate shipping containers;
- Scheduling duplicate sample submission;
- Adhering to work schedules provided by the DuPont CRG Project Manager;
- Authoring, writing, and approving of text and graphics required for field team efforts;
- Coordinating and overseeing of technical efforts of subcontractors assisting the field team;

- Identifying problems at the field team level, resolving difficulties in consultation with the DuPont project manager, implementing and documenting corrective action procedures, and providing communication between team and upper management; and

- Participating in preparation of the final report.

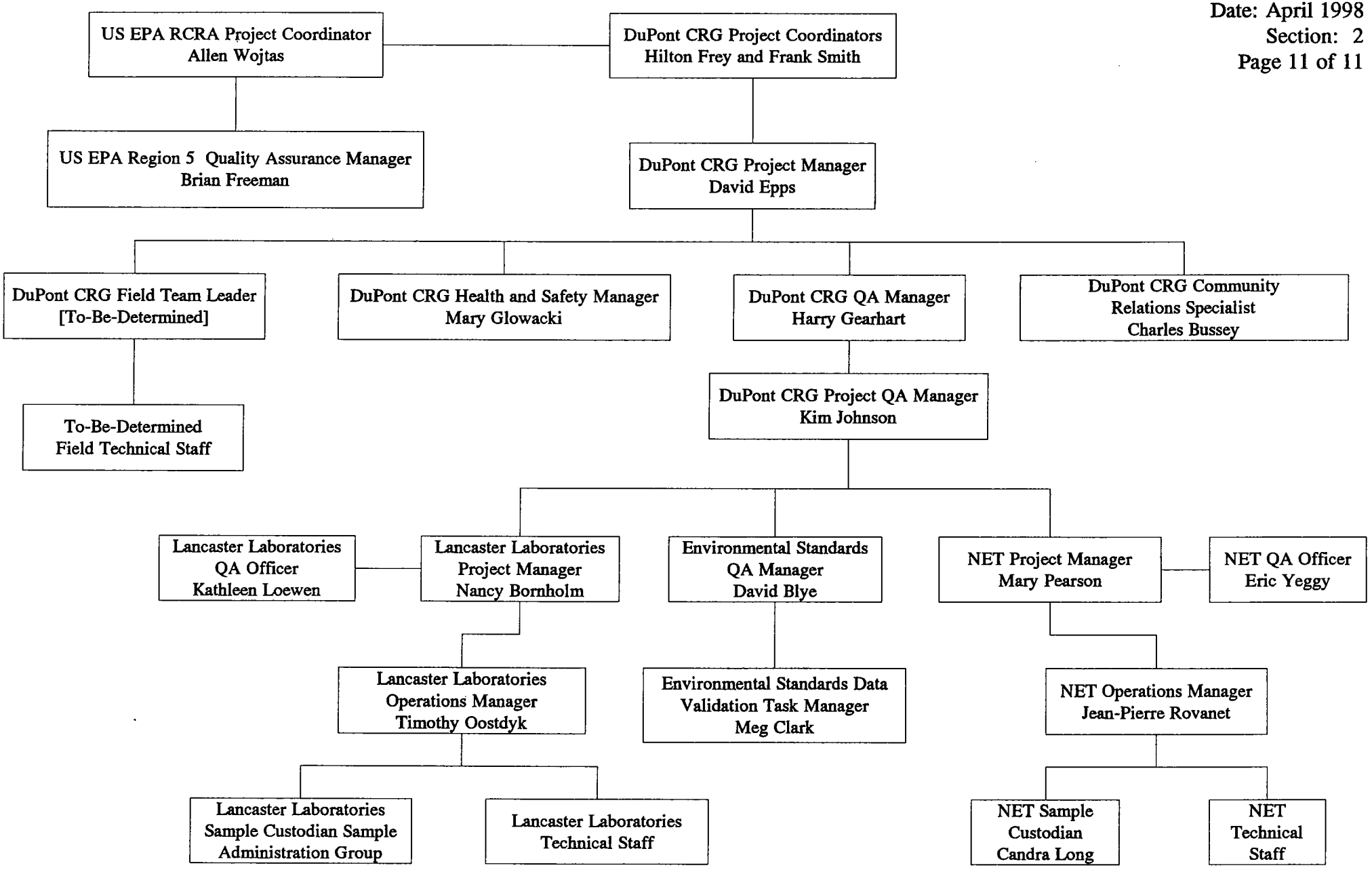
2.6.2 DuPont CRG Health and Safety Manager

The DuPont CRG Health and Safety Manager, Ms. Mary Glowacki, is responsible for the health and safety requirements for the field activities as conducted during the SCS process. She reports directly to the DuPont CRG Project Manager.

2.6.3 **[To-be-determined]** Field Technical Staff

The technical staff (team members) for this project will be drawn from **[To-be-determined]** pool of corporate resources. The technical team staff will be utilized to gather and analyze data for preparation of various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

Figure F2-1 Project Organization Chart



SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, Chain-of-Custody, laboratory analysis, and reporting that will provide defensible data of known quality (with the exception of the archived sediment sample analyses). Specific procedures for sampling, Chain-of-Custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

Data quality and quantity are measured by the comparison of resulting data with established acceptable limits for sensitivity and data precision, accuracy, representativeness, comparability, and completeness (PARCC) as described in the US EPA document EPA/540/G-87-003 titled, "Data Quality Objectives for Remedial Response Activities." With respect to sensitivity, the method detection limits and project reporting limits for all target parameters are provided in Tables F1-1 and F1-2 in Section 1 of this QAPP. The data quality objectives (DQOs), with respect to PARCC for all samples except the archived sediment samples, are summarized in Attachment F1 to this QAPP. Data that have certain aspects that may be outside PARCC DQOs will be evaluated according to Section 3.2.3 of the above DQO document and the criteria contained in the specified analytical method, to determine what, if any, aspects of the data can be defensibly used to meet the project objective. It should be noted that sediment samples that are to be archived for possible future analysis are for informational purposes only and are not to be subject to the DQOs described in this section for the remainder of the samples collected as part of the SCS.

3.1 Precision

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement. Precision will be assessed through the calculation of relative percent differences (RPDs) for two measurements and relative standard deviations (RSDs) for three or more measurements. The equations to be used for precision in this project can be found in Section 12.2 of this QAPP.

3.1.2 Field Precision Objectives

Duplicate analyses will be performed in the field for the field parameters pH, specific conductivity, and dissolved oxygen. The DQO for duplicate precision for field parameters is indicated on Table FA1-4 in Attachment F1 to this QAPP. **This table will be completed when a field team contractor has been chosen.**

Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per 20 investigative samples of a similar matrix. The total number of field duplicates for this project are found in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the SCS Work Plan. The DQO for field duplicate precision is indicated on Table FA1-1 in Attachment F1 to this QAPP.

3.1.3 Laboratory Precision Objectives

Laboratory precision is assessed through the analysis of matrix spike/matrix spike duplicates (MS/MSDs) and/or laboratory duplicates (LDs). One MS/MSD pair and/or LD will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix. The DQO for MS/MSD and LD precision are indicated on Table FA1-3 in Attachment F1 to this QAPP.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

The analysis of blanks and control standards will be performed in the field for the field parameters pH, specific conductivity, and dissolved oxygen. The DQOs for blanks and control standards for field parameters are indicated in Table FA1-4 in Attachment F1 to this QAPP. **This table will be completed when a field team contractor has been chosen.**

Accuracy in the field will be assessed through the use of equipment, bottle, and trip blanks (refer to Section 3.6) and ensured through the adherence to all sample handling, preservation, and holding time requirements. The equipment, bottle, and trip blanks to be collected for this project are indicated in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the Work Plan. The preservation and holding time requirements are indicated in Table B-4 of the FSP. The DQOs for equipment, bottle, and trip blanks are indicated on Table FA1-2 in Attachment F1 to this QAPP.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of standard reference material (SRM, metals only), MS/MSD/LDs, surrogate spikes (organics only), and laboratory control samples (LCSs) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12.1 of this QAPP. The total numbers of SRMs to be collected and analyzed for this project are indicated in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the Work Plan. One MS/MSD pair and/or MS/LD pair will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix. The DQOs for SRM, MS/MSD/LD, surrogate spike, and LCS recoveries are indicated on Table FA1-3 in Attachment F1 to this QAPP.

3.3 Completeness

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the field measurements taken in the project. The equation for completeness is presented in section 12.3 of this QAPP. The DQO for field completeness for this project is to be greater than 90 percent, as indicated in Table FA1-1 in Attachment F1 to this QAPP.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the laboratory measurements taken in the project. The equation for completeness is presented in section 12.3 of this QAPP. The DQO for laboratory completeness for this project is to be greater than 95 percent, as indicated in Table FA1-1 in Attachment F1 to this QAPP.

3.4 Representativeness

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. The sampling network was designed to provide data representative of the sediment within the reach of the GCR and adjacent wetlands contiguous with and downstream of the DuPont facility. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the RCRA program. The rationale of the sampling network is discussed in detail in Section 5 of the SCS Work Plan.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, attaining the quantitative DQOs, and meeting sample holding times. The holding time requirements for this project are indicated in Table B-4 of the FSP, which has been included as Appendix B to the SCS Work Plan. The quantitative DQOs are included as Attachment F1 to this QAPP. The SOPs to be used by the laboratory in the analysis of the samples collected for this project have been included at Attachments F2 - F11 to this QAPP.

Assessing the analytical results for field duplicate samples provides a direct measure of combined field and laboratory representativeness. The total number of field duplicates to be collected for this project is indicated in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the SCS Work Plan. The DQO for field duplicate precision is indicated on Table FA1-1 in Attachment F1 to this QAPP.

3.5 Comparability

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. The FSP has been included as Appendix B to the Work Plan. Additional information on the sampling procedures is also provided in the SOPs for the field team which have been provided as Attachment B1 to the FSP. Comparability of field data will be assessed through the evaluation of results of precision and accuracy tests. The DQOs for accuracy and precision are indicated in Tables FA1-2, FA1-3, and FA1-4 of Attachment F1 to this QAPP. **This table will be completed when a field team contractor has been chosen.**

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. The SOPs to be used by the laboratory have been included as Attachments F2 - F11 to this QAPP. These analytical SOPs are based on US EPA-approved methodology. Comparability of laboratory data will be assessed through the evaluation of the results of precision and accuracy tests. The DQOs for accuracy and precision are indicated in Tables FA1-2 and FA1-3 of Attachment F1 to this QAPP.

3.6 Level of Quality Control Effort

Equipment blanks, bottle blanks, trip blanks, method/preparation blanks, field duplicates, SRM, MS/MSD/LD samples and LCSs will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

Equipment blanks will be prepared by running organic-free reagent water through sampling equipment in the field after it has been decontaminated. The equipment blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Equipment blank samples are analyzed to check for procedural contamination at the facility which may cause sample contamination. The equipment blanks will be stored with the associated sediment or surface water samples during both shipment from the field and during laboratory storage. Equipment blanks associated with sediment samples will be analyzed using a heated purge for the BTEX fraction, just like the associated sediment samples. Equipment blanks are to be collected at a frequency of once per 20 samples (with the exception of the archived sediment samples) of a similar matrix collected using the same type of sampling equipment as indicated on Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B to the SCS Work Plan.

Bottle blanks will be submitted to the analytical laboratories to ensure that contaminants are not originating from the bottles themselves as a result of improper preparation or handling techniques. For analysis of metals in surface water, one bottle blank per lot of prepared bottles will be submitted for analysis as indicated on Table B-6 of the FSP, which has been included as Appendix B to the SCS Work Plan.

Trip blanks will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Trip blanks will be prepared by the laboratory and will accompany each shuttle of empty sample containers for BTEX analysis from the laboratory to the field. The filled sample containers will be repacked into the same cooler in which they were received in order to maintain the integrity of the trip blanks. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be prepared by filling two volatile vials with organic-free reagent water, with no headspace. The trip blanks will be stored with the associated sediment samples during both shipment from the field and during laboratory storage. Trip blanks will be analyzed for BTEX, using a heated purge just like the associated sediment samples, and will be shipped at a frequency of once per matrix per shuttle containing samples for BTEX analysis as indicated on Table B-1 of the FSP, which has been included as Appendix B to the SCS Work Plan.

Method/preparation blanks are generated within the laboratory and consist of all reagents specific to the method. Method blanks are carried through every aspect of the procedure, including preparation, clean-up, and analysis. Generally, the method/preparation blank is a volume of deionized water for all analyses of surface water samples and for BTEX, metals, and wet chemistry analyses of sediment samples, or sodium sulfate for PAH, phenols, pesticides, PCB, and herbicide analyses of sediment samples, with a volume approximately equal to the sample volume processed. Method/preparation blanks are used to assess contamination resulting from laboratory-made materials or procedures and are analyzed at a frequency of once per analytical batch of less than or equal to 20 samples of a similar matrix.

Field duplicate samples are to be collected and analyzed to check for sampling and analytical reproducibility. Field duplicates provide a measure of total analytical bias (field and laboratory variance) including bias resulting from the heterogeneity of the duplicate sample itself. Field duplicates will be collected at a minimum frequency of one per 20 samples of a similar matrix as indicated on Tables B-1, B-2, and B-6 of the FSP which has been included as Appendix B to the SCS Work Plan.

SRMs of known concentrations will be submitted to the analytical laboratories to provide a measure of analytical performance and/or analytical method bias. A SRM will be submitted from the field for metals analysis at a frequency of once per sampling event, for both sediment and surface water matrices.

MS/MSD/LDs provide information about the effect of the sample matrix on the digestion and measurement methodology. One MS/MSD and/or MS/LD pair will be prepared and analyzed for every 20 or fewer investigative samples of the same matrix. MS/MSD/LD analyses are to be performed on investigative samples. To account for the additional volume needed by the laboratory to perform the analyses, extra sample volumes will be required to be collected from the designated sediment or surface water location.

LCSs are laboratory-generated samples which consist of a known and well characterized matrix that is fortified with target analytes. LCSs are used to monitor the laboratory's day-to-day as well as ongoing performance of the applicable methods in terms of accuracy. LCSs are analyzed at a frequency of once per analytical batch of less than or equal to 20 samples of the same matrix.

Sampling procedures for quality control samples are specified in Section 3 of the FSP, provided as Appendix B of the SCS Work Plan.

SECTION 4

SAMPLING PROCEDURES

The sampling procedures to be used in this site investigation will be consistent with the purpose of this project. The FSP outlines all the sampling procedure information. The FSP has been included as Appendix B to the SCS Work Plan. Please refer to the following sections and subsections of the FSP for the following information:

- Establishing Station Locations Using a Differential Global Positioning System (DGPS) - Section 2.1
- Sediment Sampling Equipment - Table B-3
- Surface Water Sampling Equipment - Table B-7
- Surface Sediment Sampling Procedures - Section 2.2.1.1
- Shallow Sediment Core Sampling Procedures - Section 2.2.1.2
- Deep Sediment Core Sampling Procedures - Section 2.2.1.3
- Surface Water Sampling Procedures - Section 2.3.1
- Sample Containers - Table B-4
- Obtaining Contaminant-Free Sample Containers - Section 6
- QC Sample Procedures - Section 3
- Equipment Blank Collection - Section 3
- Field Duplicate Collection - Section 3
- Standard Reference Material (SRM) Preparation - Section 3
- Matrix Spike/Matrix Spike Duplicate Collection - Section 3
- Bottle Blank Preparation - Section 3
- Trip Blank Preparation - Section 3
- Sediment Sampling Equipment Decontamination - Section 2.2.3
- Surface Water Sampling Equipment Decontamination - Section 2.3.3
- Sediment Sampling Order - Section 2.2.4
- Surface Water Sampling Order - Section 2.3.4
- Field Custody Procedures - Section 5
- Sample Packaging and Shipping Procedures - Section 6
- Surface Water Hydrology/Sediment Transport Evaluation - Section 2.4
- Wetlands Evaluation - Section 2.5

SECTION 5

CUSTODY PROCEDURES

The sample custody procedures outlined in this section ensure the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. Custody is one of several factors which is necessary for the generation of defensible environmental data. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under custody if:

- the item is in actual possession of a person;
- the item is in the view of the person after being in actual possession of the person;
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

5.1 Field Custody Procedures

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound, waterproof field survey books or notebooks with consecutively numbered pages. Logbooks will be assigned to field personnel and will be stored in a secure manner when not in use.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned,
- Logbook number,
- Project name,

- Project start date, and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date and time of entry, project name and location, project number, start time of sampling activity, weather conditions, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded in the logbook. All entries will be made in indelible ink, signed, and dated and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. Whenever a sample is collected or a measurement is made, a detailed description of the location of the station, which includes latitude and longitude coordinate measurements as measured using a differential global positioning system (DGPS), shall be recorded. The number of the photographs taken of the station, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Any variance from the SCS Work Plan will be described in the Field Logbook. Minor variance will be approved by the DuPont CRG Project Manager. Major variances will be approved by the US EPA Region 5.

Samples will be collected following the sampling procedures documented in the FSP, which has been included as Appendix B to the SCS Work Plan. The equipment used to collect samples will be noted in the logbook, along with the time of sampling, sample identification number and location, sample description (source and appearance), depth at which the sample was collected, field measurements, and the types of analyses to be performed. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples will receive a sample identification which is similar to that of the original sample with the exception that the field duplicate sample identification will also have "DUP" as part of the identification.

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. Examples of field custody documents are presented in Attachment B2 of the FSP.

(a) Lancaster Laboratories will provide the appropriate sample containers, required preservatives, and shipping containers as discussed in Section 6 of the FSP, which has been included as Appendix B to the SCS Work Plan.

(b) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(c) All containers will be identified by use of sample tags, which will be attached with wire around the container neck through a reinforced hole in the tag. Sample tags will include the field sample numbers, sampling locations, date/time of collection, name of collector, type of analysis to be performed, and preservatives added. The sample numbering system is presented in Tables B-1, B-2, and B-6 of the FSP, which has been included as Appendix B of the SCS Work Plan.

(d) All containers will also be identified by the use of self-adhesive sample labels, which will be affixed to each container at the laboratory prior to shipment. Sample labels will include the field sample numbers, sampling locations, date/time of collection, name of collector, type of analysis to be performed, and preservatives added.

(e) Sample tags and labels will be completed for each sample using waterproof, permanent ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag or label because the ballpoint pen would not function in freezing weather.

(f) Samples will be accompanied by a properly completed Chain-of-Custody record. The sample numbers and locations of samples to be shipped together in the same cooler will be listed on the Chain-of-Custody record. Any cooler containing a trip blank for BTEX analysis will have a laboratory-assigned identification number which will also be listed on the Chain-of-Custody record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a laboratory, or to/from a secure storage area.

(g) Samples will be properly packaged in insulated coolers with sufficient wet ice to maintain the preservation temperature at 4 ± 2°C (for samples requiring temperature preservation) during shipment to the laboratory. Custody seals will be affixed to each sample container, across the lid and the side(s) of the sample container. Temperature bottle blanks will be supplied by the laboratory and placed in each cooler (for samples requiring temperature preservation) prior to shipment to the laboratory in order to provide a mechanism for measuring the temperature of the samples upon receipt at the laboratory. The sample

containers will be repacked into the same sample cooler in which they were received in order to maintain the integrity of the trip blanks.

(h) Sample coolers will be shipped from the field and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. Custody seals will be attached to the front right and back left of the cooler, on the edges of the lid and sides of the cooler. The custody seals will be covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

(i) All shipments will be accompanied by the Chain-of-Custody record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler for returning to the sampling office.

(j) Coolers containing surface water samples to be analyzed for the short holding time analyses (fecal coliform bacteria, BOD, and orthophosphate) will be transported to NET within several hours of collection by direct courier service provided by NET. All other sample coolers will be delivered to Lancaster Laboratories by a 24-hour delivery courier (i.e., Federal Express) at the end of each day's sampling. Commercial carriers will not be required to sign off on the custody form since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact. When the samples are sent by common carrier, a bill of lading will be used. Lancaster Laboratories will retain receipts of bills of lading as part of the permanent documentation. The shipper is responsible for ensuring adherence with currect US Department of Transportation (DOT) regulations concerning the shipment of environmental samples to the project laboratory for analysis.

5.2 Laboratory Custody Procedures

Once samples are received at laboratories, the field Chain-of-Custody is completed and signed by a laboratory sample custodian, as identified in Section 2.5.4 of this QAPP. The sample custodian will check the sample bottle tags/labels against the corresponding information listed on the field Chain-of-Custody records and note any discrepancies. Additionally, the sample custodian will note any damaged or missing sample containers. The temperature of the temperature bottle blank included in each cooler of samples requiring temperature preservation will be measured and recorded at the time of sample receipt by the sample custodian. The laboratory personnel will also check chemical preservation for all sample analyses that require

addition of acid or base by recording the pH of each sample container after the sample login process (all parameters except volatiles) or at the time of analysis (volatiles). This information will be recorded in a separate logbook. Any discrepancies in sample identifications, sample analysis information, indication that samples are missing upon receipt at the laboratory, or indication that samples not received at the correct pH or temperature (4° ± 2°C) will be communicated to the DuPont CRG Project QA Manager within 24 hours of sample receipt so that appropriate corrective action can be determined and implemented.

After the sample receipt information is checked and recorded, sample analysis information will be entered into each laboratory's laboratory information management system (LIMS). Each sample will be provided a unique laboratory identification number (Lancaster Laboratories assigns a sequential seven-digit number with a two letter sample-matrix prefix) and the analysis tests requested on the Chain-of-Custody records entered into the LIMS. Lancaster Laboratories uses their computerized system to track the custody of each sample by its unique laboratory identification number from the time of receipt through the time of disposal. In addition, after the required information has been entered into the LIMS, an internal laboratory Chain-of-Custody will be initiated by Lancaster Laboratories sample admininistration personnel. For Lancaster Laboratories, the internal Chain-of-Custody procedures will be as described in Lancaster Laboratories SOP-QA-104.02, "Quality Assurance Operations Manual, Internal Chain-of-Cusody Documentation," which has been included as Attachment F12 to this QAPP. This internal Chain-of-Custody (examples of Lancaster Laboratories' internal Chain-of-Custody are included in SOP-QA-104.02) will document the transfer of samples from the storage location to the analyst for analysis and subsequently through final disposition at the laboratory. Internal Chain-of-Custody will not be used by NET since the analyses being performed by NET are not considered critical analysis fractions.

At each laboratory, samples will be stored in secure, limited access areas in an environment that maintains any required temperature preservation. Samples for most analyses are required to be refrigerated at a temperature of 4 ± 2° C. The temperature of the refrigerators used to store samples will be monitored by the project laboratories. Samples which do not require temperature preservation will be stored at room temperature. All samples except the archived sediment samples will be analyzed as soon as possible within the maximum holding times. Maximum sample holding times are stipulated in Table B-4 of the FSP, which has been included as Appendix B to the SCS Work Plan. Sediment samples which are designated to be archived for possible future analyis for informational purposes only will be placed in an outer plastic bag to avoid cross-contamination if breakage should occur. The archived samples will be stored at Lancaster Laboratories in freezer storage maintained at a temperature of -10 ± 5°C. The archived samples will be held in this condition by Lancaster Laboratories until authorization by the DuPont CRG Project Manager to begin analysis. Disposal of unused raw sample volumes, sample extracts, and sample digestates will be in accordance with each laboratory's waste management policys. Disposal of raw samples will occur after 30 days

from the date the analysis report was issued. Sample extracts and sample digestates will also be held for a period of 30 days from the date the report was issued.

Any data recorded manually will be collected in notebooks. Any data resulting from instrument printouts will be dated and will contain the signature and/or identification of the analyst responsible for its generation. In addition, each laboratory will maintain a project file, which will contain Chain-of-Custody records as well as other project documentation/communications. Copies of the raw data and Chain-of-Custody records, as well as other project documentation (refer to Table F9-3 in Section 9 for the required laboratory data package deliverables), will be incorporated into each labortory's data package deliverables.

5.3 Final Evidence Files

DuPont, **[To-be-determined field team]**, Lancaster Laboratories, NET, and Environmental Standards are the custodians of the evidence file and maintain the contents of evidence files for the SCS, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area and under custody of the each contractor's project manager. Prior to disposal of the files by each of the subcontractors according to their individual data retention policies, the DuPont CRG Project Manager will be notified in writing and offered custody of the final evidence files. Otherwise, the contents of the final evidence file will be retained in each contractor's facility until directed by DuPont to purge their files and provide the files to DuPont.

DuPont will ensure the retention of all reports, records, or other documents for a period of at least six years after the termiantion of the pendency of the Corrective Action Order. Ninety days prior to disposal of any documentation maintained in the final evidence file at the direction of DuPont, the US EPA Region 5 will be notified in writing and offered custody of the fianl evidence file documentation. Such written notification will reference the effective date, caption, and docket number of the Corrective Action Order and will be addressed to:

Director, Waste Pesticides & Toxics Division
US EPA, Region 5
77 West Jackson Boulevard, D-8J
Chicago, Illinois 60604-3590

The final evidence file will include at a minimum:

- field logbooks;
- field data and data deliverables;

- photographs;
- drawings;
- laboratory data deliverables;
- data validation reports;
- data assessment reports;
- progress reports, QA reports, interim project reports, etc.; and
- all custody documentation (tags, forms, airbills)

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 Field Instrument Calibration

The field instruments will be calibrated as described in the field SOPs. Field instruments include a pH meter, a thermometer, a conductivity meter, and a dissolved oxygen meter. As a rule, instruments will be calibrated daily prior to use. For specific instructions on the calibration frequency, the acceptance criteria, and the conditions that will require more frequent recalibration, refer to the specific SOPs (which have been included in Attachment B1 to the FSP) for each field analysis. **[SOPs will be included in Attachment B1 of the FSP when a field staff contractor has been chosen.]**

If applicable to the measurements, the linearity of the instrument will be checked by using a 2-point calibration with reference standards bracketing the expected measurement. All the calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

[The following reflects the level of detail which will be used to describe the calibration of the field instruments. It will be updated to reflect the practices of the field staff chosen for the project or removed if already included in the field SOPs.]

6.1.1 pH Meter Calibration

The pH meter will be calibrated with standard buffer solutions before being taken to the field. In the field, the meter will be calibrated daily with two buffer solutions before use. The range of the buffer solutions will be at least three or more pH units apart and will bracket the expected pH of the sample being measured.

- Ensure that the temperature of sample and buffer are the same.

- Connect pH electrode into pH meter and turn on pH meter.
- Set temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- Recalibrate the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

6.1.2 Thermometer Calibration

Temperature readings will be taken using thermometers which have been compared to a NIST traceable thermometer. Prior to use, the thermometers will be inspected to ensure that there is no mercury separation and will be periodically checked in the field. The thermometers used will be calibrated against a NIST traceable reference thermometer by immersing both thermometers in a bath of an expected known temperature such as freezing (0°C) or boiling (100°C) and comparing the readings. If the error is more than two percent, then the thermometer should be discarded and replaced.

6.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before being taken to the field. In the field, the instrument will be checked daily with NIST (or other approved source) traceable reference standards. The calibration procedure is described below.

- Place the probe in the conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.

- Turn to appropriate scale and set the instrument for the value of calibration standard.

- Rinse off the electrode with distilled water.

6.1.4 Dissolved Oxygen Meter Calibration

The dissolved oxygen meter will be calibrated daily before being taken into the field. In the field, the meter will be checked before each set of measurements are taken and again at the end of the day. The calibration procedure is described below.

- Place the probe in a calibration bottle containing water. Wait approximately ten minutes for temperature stabilization.

- Read the temperature and refer to the instrument's Calibration Table to determine the proper calibration value. NOTE: To achieve the stated accuracy of measurement, the probe must be stabilized before calibrating. The calibration temperature must be within 5°C of the sample temperature.

- Determine the atmospheric correction factor.

- Multiply the calibration value by the atmospheric correction factor.

- Switch the instrument to the appropriate mg/l range and adjust the Calibrate control until the meter reads the calibration value computed in the previous step. Without changing the calibration setup, monitor the reading for an additional three minutes to verify calibration stability. Re-adjust if necessary.

6.2 Laboratory Instrument Calibration

Calibration procedures for a specific laboratory instrument will consist of initial calibration (2 to 5-points), initial calibration verification and continuing calibration verification. For a description of the calibration procedures for a specific laboratory instrument, refer to the applicable SOPs in Attachments F2 - F11 of this QAPP. Table F6-1 lists where calibration information can be found in each of the applicable SOPs. The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance

criteria and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, number and type of calibration solutions run, and the samples associated with these calibrations.

TABLE F6-1: LOCATION OF CALIBRATION PROCEDURES IN LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER	PAGE NUMBER
BTEX	SW-846 8260B	Analysis	Aqueous	AL-VOA-02	F2	8-11
	SW-846 8260B	Analysis	Solid	AL-VOA-03	F2	8-12
PAHs and Phenols	SW-846 3640A	Clean-up	Aqueous/Solid	AL-BNA-04	F3	4-7
	SW-846 8270C	Analysis	Aqueous/Solid	AL-BNA-05	F3	7-12
Organochlorine	SW-846 3640A	Clean-up	Aqueous/Solid	AL-PP-03	F4	4-7
Pesticides/PCBs	SW-846 8081A/8082	Analysis	Aqueous	AL-OCPP-01	F4	10-15
	SW-846 8081A/8082	Analysis	Solid	AL-OCPP-02	F4	10-14
PCBs only	SW-846 8082	Analysis	Aqueous	AL-PCB-01	F4	8-11
	SW-846 8082	Analysis	Solid	AL-PCB-02	F4	8-11
Organochlorine	SW-846 8151A	Analysis	Aqueous	AL-OCH-03	F5	7-10
Herbicide 2,4-D	SW-846 8151A	Analysis	Solid	AL-OCH-04	F5	7-9
Organochlorine	SW-846 8000 series	Calibration	Aqueous/Solid	AL-GC-01	F6	All
Pesticides/PCBs/ Herbicide	SW-846 8000 series	Data Review	Aqueous/Solid	AL-GC-05	F6	2-3
Metals except	SW-846 3010A/3050B/6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7	C1-20
Mercury by ICP	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7	All
(trace)	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7	3-4
Simultaneously	SW-846 6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7	C1-20
Extracted Metals	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7	All
except Mercury by ICP (trace)	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7	3-4
Mercury	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7	E1-5
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8	3-6
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8	7
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8	9-10
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8	All
Simultaneously	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7	E1-5
Extracted Mercury	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8	3-6
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8	7
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8	9-10
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8	All
Arsenic and Lead	SW-846 3000/7000 series	Standard Preparation	Aqueous/Solid	AL-MET-03	F7	F1-10
by GFAA	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8	9-10
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-16	F9	3-7
Lead by GFAA	SW-846 7421	Analysis	Aqueous/Solid	AL-MET-17	F9	3-6
Arsenic and Lead by GFAA	SW-846 7060A/7421	Analysis	Aqueous/Solid	AL-MET-20	F9	All
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-21	F9	All
Acid Volatile Sulfides	EPA/821-R-91-100	All	Aqueous/Solid	AL-WET-01	F10	7-8
Total Cyanide, Phenolics, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus	SW-846 9012A, 9066 EPA 350.1, 351.2, 365.1	Quality Control	Aqueous/Solid	AL-WET-02	F10	8-9
Total Cyanide	SW-846 9012A	Analysis	Aqueous/Solid	AL-WET-04	F10	16-17
Phenolics	SW-846 9066	Analysis	Aqueous/Solid	AL-WET-08	F10	10-11

TABLE F6-1: LOCATION OF CALIBRATION PROCEDURES IN LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER	PAGE NUMBER
Soluble Fluoride, Soluble Sulfate, Nitrate/Nitrite Nitrogen	SW-846 9056	Analysis	Aqueous/Solid	AL-WET-10	F10	15-16
Total Sulfide	SW-846 9030B/9034	All	Aqueous/Solid	AL-WET-11	F10	4
Ammonia Nitrogen	EPA 350.1	Analysis	Aqueous/Solid	AL-WET-13	F10	11-12
Total Kjeldahl Nitrogen	EPA 351.2	Analysis	Aqueous/Solid	AL-WET-16	F10	10-11
Total Phosphorus	EPA 365.1	All	Aqueous/Solid	AL-WET-17	F10	15-16
pH	SW-846 9045C	Calibration	Solid	AL-WET-18	F10	All
	SW-846 9045C	Analysis	Solid	AL-WET-19	F10	2
Total Organic Carbon	EPA 415.1	All	Aqueous	AL-WET-20	F10	11
(Soluble)	EPA 415.1	All	Solid	AL-WET-21	F10	15,17
Chemical Oxygen Demand	EPA 410.4	All	Aqueous	AL-WET-24	F10	3
Hardness	EPA 130.2	All	Aqueous	AL-WET-26	F10	4
Fecal Coliform Bacteria	SM 9221C	All	Aqueous	AL-WET27	F10	3-4
Biochemical Oxygen Demand	EPA 405.1	All	Aqueous	AL-WET-28	F11	9
Orthophosphate	EPA 365.2	All	Aqueous	AL-WET-29	F11	11

SECTION 7

ANALYTICAL PROCEDURES

Sediment and surface water samples collected during field sampling activities for the DuPont East Chicago SCS, with the exception of surface water samples collected for wet chemistry analyses with short holding times (≤48 hours), will be analyzed by Lancaster Laboratories of Lancaster, Pennsylvania. The surface water samples collected for wet chemistry analyses with short holding times (≤48 hours) will be analyzed by NET of Bartlett, Illinois. The addresses and telephone numbers for these laboratories are provided below.

1. All laboratory parameters except wet chemistry with ≤48 hour holding times in surface water:
   Lancaster Laboratories
   2425 Holland Pike
   Lancaster, Pennsylvania 17601-5994
   Tel: (717) 656-2300

2. Wet chemistry with ≤48 hour holding times in surface water:
   NET
   850 West Bartlett Rd.
   Bartlett, Illinois 60103
   Tel: (630) 289-3100

7.1 Field Measurement Procedures

The standardization and QA information for field measurements of pH, specific conductivity, temperature, and dissolved oxygen are described in Sections 3 and 6 of this QAPP. **SOPs for these analyses will be included in Attachment B1 to the FSP when a field staff contractor has been chosen.**

7.2 Laboratory Analytical Procedures

The laboratories named above will implement the project-required SOPs, which have been included as Attachments F2 - F11 to this QAPP. These laboratory SOPs for sample preparation, cleanup, and analysis are based on *"Test Methods for Evaluating Solid Waste,*

Physical/Chemical Methods (SW-846) Third Edition" (Final Update III, December 1996), EPA-600/4-79-020 *"Methods for Chemical Analysis of Water and Wastes"* (March 1983), EPA/600/R-93/100 *"Methods for the Determination of Inorganic Substances in Environmental Samples"* (August 1993), *"Standard Methods for the Examination of Water and Wastewater"* (19th Edition, 1995), and *"American Society for Testing and Materials (ASTM) Annual Book of Standards."* These SOPs provide sufficient detail to perform the analyses and are specific to this SCS.

Table F7-1 summarizes the EPA method references and corresponding laboratory SOP numbers for the analysis procedures to be used for each analytical parameter group in the sediment and aqueous (aqueous blanks or surface water) matrices to be evaluated in this investigation. For samples requiring both pesticide and PCB analyses, the samples will first be analyzed for pesticides and PCBs together using SW-846 Method 8081A with PCB calibration according to SW-846 Method 8082 in the same analytical sequence. Since some PCB peaks may co-elute or overlap with the pesticide peaks of interest, the joint calibration allows for better interpretation of the peaks observed for each sample. This practice will allow for quantitation of the same peak for two different parameters to be avoided/qualified. If a sample analysis exhibits flat baselines or just a small number of distinct peaks, the joint analysis will be deemed sufficient to cover both the pesticide and PCB analyses. However, if significant matrix interference is observed for any sample, Lancaster Laboratories will perform a separate PCB analysis of a sulfuric acid-treated fraction of the sample extract in accordance with SW-846 Method 8082 to identify and quantitate PCBs. Many of the sediment and surface water samples may contain matter (e.g., high oil and grease content, etc.) that could interfere with a number of the analyses, as discussed in Section 1.4.2 of this QAPP. If significant interferences are observed by the analyst for the ICP analyses for arsenic and/or lead, secondary analyses for these analytes may be performed by graphite furnace atomic absorption by the analytical methods listed in Table F7-1. These situations will be brought to the attention of the Environmental Standards Data Validation Task Manager for discussion with the SCS project team so that the alternate methods may be used, if appropriate.

The preparation and organic cleanup methods and corresponding laboratory SOP numbers are also provided in Table F7-1. Sulfuric acid cleanup (SW-846 Method 3665A) will be used for all PCB-only analyses. As previously stated, many of the sediment and surface water samples may contain matter (e.g., high oil and grease content) that could interfere with a number of the analyses, (this is discussed in Section 1.4.2 of this QAPP). Therefore, the cleanup procedures listed in Table F7-1 will be used if deemed necessary by the analyst to remove interfering

peaks and/or to remove materials that may cause deterioration and/or loss of detector sensitivity.

The SOPs listed in Table F7-1 are provided in Attachments F2 - F11, as also specified in Table F7-1.

Lancaster Laboratories SOPs on "Validation and Authorization of Analytical Methods" (Lancaster Laboratories SOP-QA-106.01) and "Determining Method Detection Limits and Limits of Quantitation" (Lancaster Laboratories SOP-LA-034) have been provided in Attachment F13 of this QAPP.

7.2.1 List of Project Target Compounds and Laboratory Detection Limits

A complete listing of project target compounds, PQLs, and current laboratory-determined MDLs for each analyte group listed in Table F7-1 can be found in Tables F1-1 and F1-2 of this QAPP. The surface water samples will be analyzed for both total and dissolved metals for the metals listed on Table F1-2. MDLs shown have been experimentally determined using the method found in the 40 CFR Part 136, Appendix B.

7.2.2 List of Associated QC Samples

The definitions and frequency for QC samples with respect to PARCC are stated in Section 3 of this QAPP. The laboratory preparation and analysis SOPs include a "Quality Assurance" or "Quality Control" section which addresses the minimum QC requirements for the analysis of specific analyte groups. The page number location for this section in each SOP is provided in Table F7-2.

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
BTEX	SW-846 5035	Preparation	Solid	AL-VOA-01	F2
	SW-846 8260B	Analysis	Aqueous	AL-VOA-02	F2
	SW-846 8260B	Analysis	Solid	AL-VOA-03	F2
PAHs and Phenols	SW-846 3510C	Preparation	Aqueous	AL-BNA-01	F3
	SW-846 3550B	Preparation	Solid (Low-Level)	AL-BNA-02	F3
	SW-846 3550B	Preparation	Solid (Medium-Level)	AL-BNA-03	F3
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-BNA-04	F3
	SW-846 8270C	Analysis	Aqueous/Solid	AL-BNA-05	F3
Organochlorine	SW-846 3510C	Preparation	Aqueous	AL-PP-01	F4
Pesticides/PCBs	SW-846 3550B	Preparation	Solid	AL-PP-02	F4
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-PP-03	F4
	SW-846 3660B	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 3630C	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 3620B	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 8081A/8082	Analysis	Aqueous	AL-OCPP-01	F4
	SW-846 8081A/8082	Analysis	Solid	AL-OCPP-02	F4
PCBs only	SW-846 3665A	Clean-up	Aqueous/Solid	AL-PP-04	F4
	SW-846 8082	Analysis	Aqueous	AL-PCB-01	F4
	SW-846 8082	Analysis	Solid	AL-PCB-02	F4
Organochlorine Herbicide	SW-846 3510C/8151A	Preparation	Aqueous	AL-OCH-01	F5
2,4-D	SW-846 3550B/8151A	Preparation	Solid	AL-OCH-02	F5
	SW-846 8151A	Analysis	Aqueous	AL-OCH-03	F5
	SW-846 8151A	Analysis	Solid	AL-OCH-04	F5
Organochlorine	SW-846 8000 series	Calibration	Aqueous/Solid	AL-GC-01	F6
Pesticides/PCBs/	SW-846 8000 series	Chromatography	Aqueous/Solid	AL-GC-02	F6
Herbicide	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-03	F6
	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-04	F6
	SW-846 8000 series	Data Review	Aqueous/Solid	AL-GC-05	F6
Metals except	SW-846 3010A	Preparation	Aqueous	AL-MET-01	F7
Mercury by ICP	SW-846 3050B	Preparation	Solid	AL-MET-02	F7
(trace)	SW-846 3010A/3050B/6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7
	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7
Simultaneously	EPA/821-R-91-100	Preparation	Aqueous/Solid	AL-WET-01	F10
Extracted Metals except	SW-846 6010B	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
Mercury by	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7
ICP (trace)	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
Mercury	SW-846 7470A	Preparation	Aqueous	AL-MET-06	F8
	SW-846 7470A	Preparation	Aqueous	AL-MET-07	F8
	SW-846 7471A	Preparation	Solid	AL-MET-08	F8
	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Simultaneously Extracted Mercury	EPA/821-R-91-100	Preparation	Aqueous/Solid	AL-WET-01	F10
	SW-846 7470A/7471A	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Arsenic and Lead by GFAA	SW-846 3020A	Preparation	Aqueous	AL-MET-14	F9
	SW-846 3050B	Preparation	Solid	AL-MET-15	F9
	SW-846 3000/7000 series	Standard Preparation	Aqueous/Solid	AL-MET-03	F7
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8
	SW-846 7000 series GFAA	Quality Control	Aqueous/Solid	AL-MET-22	F9
	SW-846 7000 series	Calculations	Aqueous/Solid	AL-MET-13	F8
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-16	F9
Lead by GFAA	SW-846 7421	Analysis	Aqueous/Solid	AL-MET-17	F9
Arsenic and Lead by GFAA	SW-846 7060A/7421	Analysis	Aqueous/Solid	AL-MET-20	F9
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-21	F9
Acid Volatile Sulfides	EPA/821-R-91-100	All	Aqueous/Solid	AL-WET-01	F10
Total Cyanide, Phenolics, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus	SW-846 9012A, 9066 EPA 350.1, 351.2, 365.1	Quality Control	Aqueous/Solid	AL-WET-02	F10
Total Cyanide	SW-846 9012A	Preparation	Aqueous/Solid	AL-WET-03	F10
	SW-846 9012A	Analysis	Aqueous/Solid	AL-WET-04	F10
Oil & Grease	SW-846 9071A	All	Aqueous	AL-WET-05	F10
	SW-846 9071A	All	Solid	AL-WET-06	F10

TABLE F7-1: PREPARATION, CLEAN-UP, AND ANALYSIS LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER
Phenolics	SW-846 9065	Preparation	Aqueous/Solid	AL-WET-07	F10
	SW-846 9066	Analysis	Aqueous/Solid	AL-WET-08	F10
Soluble Fluoride and Soluble Sulfate	SW-846 9056	Preparation	Solid	AL-WET-09	F10
Soluble Fluoride, Soluble Sulfate, and Nitrate/Nitrite Nitrogen	SW-846 9056	Analysis	Aqueous/Solid	AL-WET-10	F10
Total Sulfide	SW-846 9030B/9034	All	Aqueous/Solid	AL-WET-11	F10
Ammonia Nitrogen	EPA 350.2	Preparation	Solid	AL-WET-12	F10
	EPA 350.1	Analysis	Aqueous/Solid	AL-WET-13	F10
Total Kjeldahl	EPA 351.2	Preparation	Aqueous	AL-WET-14	F10
Nitrogen	EPA 351.2	Preparation	Solid	AL-WET-15	F10
	EPA 351.2	Analysis	Aqueous/Solid	AL-WET-16	F10
Total Phosphorus	EPA 365.1	All	Aqueous/Solid	AL-WET-17	F10
pH	SW-846 9045C	Calibration	Solid	AL-WET-18	F10
	SW-846 9045C	Analysis	Solid	AL-WET-19	F10
Total Organic Carbon	EPA 415.1	All	Aqueous	AL-WET-20	F10
(Soluble)	EPA 415.1	All	Solid	AL-WET-21	F10
Total Solids	EPA 160.3	All	Solid	AL-WET-22	F10
Grain Size	ASTM D422-63	All	Solid	AL-WET-23	F10
Chemical Oxygen Demand	EPA 410.4	All	Aqueous	AL-WET-24	F10
Total Suspended Solids	EPA 160.2	All	Aqueous	AL-WET-25	F10
Hardness	EPA 130.2	All	Aqueous	AL-WET-26	F10
Fecal Coliform Bacteria	SM 9221C	All	Aqueous	AL-WET-27	F11
Biochemical Oxygen Demand	EPA 405.1	All	Aqueous	AL-WET-28	F11
Orthophosphate	EPA 365.2	All	Aqueous	AL-WET-29	F11

TABLE F7-2: LOCATION OF QUALITY CONTROL PROCEDURES IN LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER	PAGE NUMBER
BTEX	SW-846 8260B	Analysis	Aqueous	AL-VOA-02	F2	14-17
	SW-846 8260B	Analysis	Solid	AL-VOA-03	F2	15-18
PAHs and Phenols	SW-846 3510C	Preparation	Aqueous	AL-BNA-01	F3	7-8
	SW-846 3550B	Preparation	Solid (Low-Level)	AL-BNA-02	F3	7
	SW-846 3550B	Preparation	Solid (Medium-Level)	AL-BNA-03	F3	6
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-BNA-04	F3	7
	SW-846 8270C	Analysis	Aqueous/Solid	AL-BNA-05	F3	17-18
Organochlorine	SW-846 3510C	Preparation	Aqueous	AL-PP-01	F4	11
Pesticides/PCBs	SW-846 3550B	Preparation	Solid	AL-PP-02	F4	9
	SW-846 3640A	Clean-up	Aqueous/Solid	AL-PP-03	F4	7-8
	SW-846 8081A/8082	Analysis	Aqueous	AL-OCPP-01	F4	17
	SW-846 8081A/8082	Analysis	Solid	AL-OCPP-02	F4	16-17
PCBs only	SW-846 8082	Analysis	Aqueous	AL-PCB-01	F4	12
	SW-846 8082	Analysis	Solid	AL-PCB-02	F4	13
Organochlorine	SW-846 3510C/8151A	Preparation	Aqueous	AL-OCH-01	F5	14
Herbicide 2,4-D	SW-846 3550B/8151A	Preparation	Solid	AL-OCH-02	F5	14
	SW-846 8151A	Analysis	Aqueous	AL-OCH-03	F5	11
	SW-846 8151A	Analysis	Solid	AL-OCH-04	F5	10-11
Organochlorine	SW-846 8000 series	Chromatography	Aqueous/Solid	AL-GC-02	F6	3
Pesticides/PCBs/	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-03	F6	All
Herbicide	SW-846 8000 series	Quality Control	Aqueous/Solid	AL-GC-04	F6	All
	SW-846 8000 series	Data Review	Aqueous/Solid	AL-GC-05	F6	All
Metals except	SW-846 3010A	Preparation	Aqueous	AL-MET-01	F7	4
Mercury by ICP (trace)	SW-846 3050B	Preparation	Solid	AL-MET-02	F7	5-6
	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7	8
	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7	All
Simultaneously	SW-846 6010B	Analysis	Aqueous/Solid	AL-MET-04	F7	8
Extracted Metals	SW-846 6010B	Data Review	Aqueous/Solid	AL-MET-05	F7	All
except Mercury by ICP (trace)						
Mercury	SW-846 7470A	Preparation	Aqueous	AL-MET-06	F8	11
	SW-846 7470A	Preparation	Aqueous	AL-MET-07	F8	5-6
	SW-846 7471A	Preparation	Solid	AL-MET-08	F8	4
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8	6-7
	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8	10-11
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8	All
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8	All
Simultaneously	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-09	F8	6-7
Extracted Mercury	SW-846 7470A/7471A	Analysis	Aqueous/Solid	AL-MET-10	F8	10-11
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-11	F8	All
	SW-846 7470A/7471A	Quality Control	Aqueous/Solid	AL-MET-12	F8	All
Arsenic and Lead	SW-846 3020A	Preparation	Aqueous	AL-MET-14	F9	4
by GFAA	SW-846 3050B	Preparation	Solid	AL-MET-15	F9	5
	SW-846 7000 series GFAA	Quality Control	Aqueous/Solid	AL-MET-11	F8	All
	SW-846 7000 series	Quality Control	Aqueous/Solid	AL-MET-22	F9	All

TABLE F7-2: LOCATION OF QUALITY CONTROL PROCEDURES IN LABORATORY SOPS

PARAMETER(S)/ PARAMETER GROUP	ANALYTICAL METHOD	SOP TYPE	MATRIX	SOP NUMBER(S)	ATTACHMENT NUMBER	PAGE NUMBER
Arsenic by GFAA	SW-846 7060A	Analysis	Aqueous/Solid	AL-MET-16	F9	8
Lead by GFAA	SW-846 7421	Analysis	Aqueous/Solid	AL-MET-17	F9	7
Acid Volatile Sulfides	EPA/821-R-91-100	All	Aqueous/Solid	AL-WET-01	F10	9
Total Cyanide, Phenolics, Ammonia Nitrogen, Total Kjeldahl Nitrogen, Total Phosphorus	SW-846 9012A, 9066 EPA 350.1, 351.2, 365.1	Quality Control	Aqueous/Solid	AL-WET-02	F10	All
Total Cyanide	SW-846 9012A	Preparation	Aqueous/Solid	AL-WET-03	F10	9-11
	SW-846 9012A	Analysis	Aqueous/Solid	AL-WET-04	F10	16-18
Oil & Grease	SW-846 9071A	All	Aqueous	AL-WET-05	F10	5
	SW-846 9071A	All	Solid	AL-WET-06	F10	5
Phenolics	SW-846 9065	Preparation	Aqueous/Solid	AL-WET-07	F10	4-5
	SW-846 9066	Analysis	Aqueous/Solid	AL-WET-08	F10	10-11
Soluble Fluoride,	SW-846 9056	Preparation	Solid	AL-WET-09	F10	3-4
Soluble Sulfate,	SW-846 9056	Analysis	Aqueous/Solid	AL-WET-10	F10	15-19
Nitrate/Nitrite Nitrogen						
Total Sulfide	SW-846 9030B/9034	All	Aqueous/Solid	AL-WET-11	F10	4
Ammonia Nitrogen	EPA 350.2	Preparation	Solid	AL-WET-12	F10	4
	EPA 350.1	Analysis	Aqueous/Solid	AL-WET-13	F10	11-14
Total Kjeldahl	EPA 351.2	Preparation	Aqueous	AL-WET-14	F10	10-11
Nitrogen	EPA 351.2	Preparation	Solid	AL-WET-15	F10	8-9
	EPA 351.2	Analysis	Aqueous/Solid	AL-WET-16	F10	10-12
Total Phosphorus	EPA 365.1	All	Aqueous/Solid	AL-WET-17	F10	15-17
pH	SW-846 9045C	Analysis	Solid	AL-WET-19	F10	4
Total Organic Carbon	EPA 415.1	All	Aqueous	AL-WET-20	F10	11-13
(Soluble)	EPA 415.1	All	Solid	AL-WET-21	F10	15-17
Total Solids	EPA 160.3	All	Solid	AL-WET-22	F10	4
Grain Size	ASTM D422-63	All	Solid	AL-WET-23	F10	11
Chemical Oxygen Demand	EPA 410.4	All	Aqueous	AL-WET-24	F10	6
Total Suspended Solids	EPA 160.2	All	Aqueous	AL-WET-25	F10	8
Hardness	EPA 130.2	All	Aqueous	AL-WET-26	F10	6
Fecal Coliform Bacteria	SM 9221C	All	Aqueous	AL-WET-27	F11	3-5
Biochemical Oxygen Demand	EPA 405.1	All	Aqueous	AL-WET-28	F11	11-13
Orthophosphate	EPA 365.2	All	Aqueous	AL-WET-29	F11	15-24

SECTION 8

INTERNAL QUALITY CONTROL CHECKS

QC checks are operational techniques and activities that are used to fulfill the requirements of QA policies. QC is an integrated system of activities in the areas of quality planning, quality assessment, and quality improvement. These activities are included to provide the program with a measurable assurance that the required standards of quality are met. The intent of the internal quality control program is to detect potential problems at the source and, if necessary, trace the sample analytical pathways for introduction of contamination. The quality control data generated in the field will be used to monitor sampling technique, reproducibility, and cleanliness. Quality control data generated by the laboratory will monitor not only reproducibility (precision) in the laboratory methods and cleanliness but also accuracy in samples submitted for analysis. During the data validation process, variability in sampling technique and laboratory performance will be assessed separately. The interrelation of these QC checks is described in the subsections that follow.

8.1 Field Quality Control Checks

QC procedures for pH, specific conductance, temperature, and dissolved oxygen measurements of surface water samples will include calibrating the instruments, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. The QC information with respect to the calibration of field equipment is stated in Section 6 of this QAPP. The QC information for field equipment with respect to PARCC is stated in Section 3 of this QAPP. The thermometer used will be compared to a NIST-traceable thermometer (or equivalent). Sediment color checks will be done using Munsell color charts. The results of all QC analyses and any corrective actions performed for the field parameters will be recorded in the field logbooks.

To achieve the overall data quality objectives, proper sample collection and handling procedures must be followed. The sample collection and handling procedures are documented in the FSP, included as Appendix B to the Work Plan. Assessment of field sampling precision and bias will be made by collecting field duplicates, MS/MSD samples, trip blanks, bottle blanks, and equipment blanks for laboratory analysis. Definitions and the frequency requirements for each QC sample type is discussed in Section 3 of this QAPP. The QC frequency is also summarized on Tables B-1, B-2, and B-6 of the FSP. Collection of these QC samples will be in accordance with the applicable procedures in Section 2 of the FSP.

8.2 Laboratory Quality Control Checks

The laboratories identified in Section 7 of this QAPP have QC programs that each laboratory uses to ensure the reliability and validity of the analysis performed at that particular laboratory. All analytical procedures are documented in writing as SOPs, and each SOP includes a "Quality Assurance" or "Quality Control" section which addresses the minimum QC requirements for the procedure. The page number location for this section in each applicable SOP has been provided in Table F7-2 in Section 7 of this QAPP. The internal quality control checks might differ slightly for each individual analytical procedure but in general the QC requirements include the following:

- A minimum of one procedural blank (method/preparation blank) in every 20 samples of a similar matrix analyzed to detect contamination;

- A minimum of one matrix spike/matrix spike duplicate pair or matrix spike/laboratory duplicate per every 20 samples to determine accuracy, precision, and the presence of matrix effects;

- Surrogate spikes for organic analyses to determine recoveries and to account for sample-to-sample variation;

- A minimum of one laboratory control standard for every batch of less than or equal to 20 samples of a similar matrix to determine recovery;

- Multilevel initial calibration of instruments to establish calibration curves plus the analysis continuing calibration standards (organics) for accurate quantitation or calibration verifications (metals and general chemistry), and recalibration if these do not meet criteria;

- Mass tuning for GC/MS systems every 12 hours to meet SOP criteria using the compound bromofluorobenzene (BFB) for BTEX and the compound decafluorotriphenylphosphine (DFTPP) for PAH and phenol analysis;

- Internal standard areas for gas chromatography/mass spectrometry (GC/MS) analysis to quantitate results and to account for sample-to-sample variation;

- Endrin/DDT degradation check for pesticide analysis by gas chromatography/electron capture detector analysis (GC/ECD) to measure the decomposition of endrin and DDT into breakdown components;

- Analysis on a second, dissimilar GC column analysis by GC/ECD for qualitative confirmation;

- Calibration blanks for metals analysis prior to and between the analysis of samples;

- Inductively Coupled Plasma (ICP) Interference Check Standards after initial calibration, and after samples are analyzed;

- An ICP Serial Dilution Analysis for every 20 samples of a similar matrix;

- A graphite furnace atomic absorption (GFAA) post-digestion spike for every 20 samples of a similar matrix; and

- Control limits determined by the laboratories (these are listed in Tables FA1-2 and FA1-3 in Attachment F1 to this QAPP).

For a description of the specific QC requirements of this facility investigation and the frequency of audit, refer to the submitted SOPs. The control limits for the method/preparation blanks, matrix spikes, matrix spike duplicates, laboratory control samples, and surrogate spikes are listed in Tables FA1-2 and FA1-3 in Attachment F1 to this QAPP. Additional QC criteria (internal standard areas, degradation checks, ICP interference checks, for example) are included throughout the analytical SOPs, provided as Attachments F2 – F11 to this QAPP.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria that are not attributable to sample matrix interferences will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis, when necessary.

SECTION 9

DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities or by laboratory operations shall be reduced and validated prior to reporting. No data shall be disseminated by the laboratory until it has been subjected to these procedures which are summarized in subsections below:

9.1 Data Reduction

Data reduction involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements, and calculations.

Data reduction occurs with

- The work plan through sample locations and naming conventions,
- The field sampling process through use of field logs and field measurements,
- Field communications with the laboratory in sample analysis requests,
- Field operations with collection, preservation, and Chain-of-Custody documentation,
- Laboratory operations with sample receipt and handling, sample preparation and analysis, collation of raw data, and generation of laboratory results, and
- Post-laboratory operations with collation of analytical results in a format suitable for documents such as reports, maps, and trend plots.

Data reduction steps include field operations, laboratory operations, and report preparation operations.

Specific QC measures developed to ensure accuracy throughout the data reduction process are described in Sections 10 and 12.

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct read instrumentation will be employed in the field. The use of pH meters, thermometers, a dissolved oxygen meter, and a probe to measure specific conductance will generate some measurements directly read from the meters following calibration per manufacturer's recommendations as outlined in Section 6 of this QAPP. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results forms required for this study are being filled out, the DuPont CRG Field Team Leader, identified in Section 2.6.1 of this QAPP, will proof the forms to determine whether any transcription errors have been made by the field crew.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the following protocol. All raw analytical data will be recorded in each laboratory's Laboratory Information Management Systems (LIMS) and tabular summary tables will be generated. Data are recorded in each laboratory's LIMS, along with other pertinent information, such as the sample identification number, the analytical method used, the name of the analyst, the date of analysis, and matrix sampled. At a minimum, reagent concentrations, instrument settings, and raw data are retained by hard copy and laboratory notebooks, which shall be signed and dated by the analyst. Copies of any strip chart printouts (such as gas chromatograms) will be maintained on file. Periodic review of raw data and of the computerized records by the laboratory Quality Assurance Officer takes place prior to final data reporting.

For this project, the equations that will be employed in reducing data are presented in the laboratory SOPs, which have been included in Attachments F2 - F11 to this QAPP. (In addition, two of these equations, expressing analytical accuracy and precision, have been presented in Section 12 of this QAPP.) Such formulae make pertinent allowance for matrix type. All calculations will be checked by the laboratory technical staff. Errors will be noted, and corrections will be made. The original notations will be crossed out legibly. Analytical results for sediment samples shall be calculated and reported on a dry-weight basis.

Quality control data (e.g., laboratory duplicates, surrogates, matrix spikes, and matrix spike duplicates) will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the laboratory Quality Assurance Officer for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the laboratory Quality Assurance Officer approves these data, they are considered ready for third-party data validation.

9.2 Data Validation

Data validation is the process of verifying that qualitative and quantitative information generated relative to a given sample is complete and accurate. Data validation procedures shall be performed for both field and laboratory operations as described below:

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors on the part of the field crew members and review of field log books. These procedures are performed to ensure that field measurements and various quality control analyses were properly performed and documented. The field data documented includes those generated during measurement of field parameters, observations, results of any quality control sample analyses, and field instrument calibrations. This task will be the responsibility of the DuPont CRG Field Team Leader, who will otherwise not participate in making any of the field measurements or in adding notes, data or other information to the log book.

9.2.2 Procedures to Validate Laboratory Data

All of the analytical data generated by the project laboratories during the SCS, with the exception of data generated from the analysis of archived samples, will undergo an independent data review by trained reviewers independent to the laboratory under the direction of the Environmental Standards Data Validation Task Manager. (The role of the Environmental Standards Data Validation Task Manager is indicated in the Project Organization [Section 2.3.3] of this QAPP.) The validation of the laboratory data will be performed with guidance from the "*US EPA Contract Laboratory Program National*

Functional Guidelines for Organic Data Review," (February 1994) and the "*US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,"* (February 1994). These documents provide most of the criteria by which data are accepted or rejected and were used as a basis in developing the data validation SOPs listed in Table F9-1. These data validation SOPs have been provided in Attachment F14 to this QAPP and will provide the specific criteria used to validate the data for each analytical parameter for the SCS.

Analytical data from critical analysis fractions (BTEX, PAHs, phenols, organochlorine pesticides, PCBs, organochlorine herbicide 2,4-D, metals, total cyanide, AVS, and SEM) will undergo a full validation process. Full validation will include an evaluation of all documented QA/QC measures through a review of all tabulated QC summary forms and all raw instrument data. A percentage (20%) of analytical data from non-critical analysis fractions (all wet chemistry except total cyanide and AVS) will also undergo the full validation process. All data that are not validated in full will undergo a limited validation process. Limited validation will include an evaluation of a limited number of QA/QC measures (holding times, blank contamination including method, trip, and equipment blanks, precision and accuracy based on the results of the LCS and MS/MSD, and field duplicate precision and sample representativeness) through a review of tabulated QC summary forms applicable to those measures. Limited validation will not include an evaluation of any raw instrument data.

A preliminary review will be performed to verify that all necessary paperwork (Chain-of-Custody records, analytical reports, laboratory personnel signatures) and deliverables (as specified in the SCS Work Plan and QAPP) for the analyses are present. At a minimum, deliverables will include sample Chain-of-Custody records, a detailed case narrative, analytical results, calibration summaries, QC summaries, and supporting raw data from instrument printouts as specified in Section 9.3.2 of this QAPP. The Data Validation Task Manager will contact a project laboratory to request the correction of certain deficiencies prior to the submittal of the Quality Assurance Review, if such corrections are necessary for a full evaluation of the usability of the data. Such correctable deficiencies may include missing data deliverables or calculation errors that would take a significant amount of the staff reviewer's time to correct. In addition, the Data Validation Task Manager may contact a project laboratory to request the correction of all correctable deficiencies prior to the submittal of the Quality Assurance Review, if time allows. Any laboratory resubmittals as a

result of such requests will be discussed in the appropriate "Comments" section of the Quality Assurance Review.

A detailed review will be performed by the Environmental Standards Data Validation Task Manager or staff reviewer of Environmental Standards to independently verify compliance to the required analytical protocols and to determine the qualitative and quantitative reliability of the data as they are presented. Full validation will include a detailed review and interpretation of all data generated by the laboratory. Limited validation will include a detailed review and interpretation of the tabulated QC summary forms which are applicable to the required QA/QC measures. The primary tools which will be used by experienced data review chemists are to be guidance documents, established (contractual) criteria, the data validation SOPS provided in Attachment F14 to the QAPP, and professional judgment.

Based upon the review of the analytical data, a Quality Assurance Review will be prepared which will summarize the qualitative and quantitative reliability of the analytical data. During the course of the data review, a full organic, inorganic, and general chemistry support documentation package will be prepared from the deliverables provided by the laboratory which will provide backup information that will accompany all qualifying statements presented in the quality assurance review. Table F9-2) provides a summary of the Quality Assurance Review report format, including the support documentation packages.

Based upon the quality assurance review of the analytical data, the following qualifier codes will be placed next to specific sample results on sample result summaries (included in Section 2 of the Quality Assurance Review as noted in Table F9-2). These defined qualifier codes will serve as an indication of the qualitative and quantitative reliability.

The data qualifier codes and definitions will be as follows:

U - This compound/analyte should be considered "not detected" since it was detected in a blank at a similar level.

J - Quantitation is approximate due to limitations identified during the quality assurance review (data validation).

N - The analysis indicates that there is presumptive evidence to make a "tentative identification" of this compound/analyte.

R - Unusable result – compound/analyte may or may not be present in this sample.

UJ - This compound/analyte was not detected, but the quantitation/detection limit is probably higher due to a low bias identified during the quality assurance review.

Once the review has been completed, the Environmental Standards Data Validation Task Manager will submit the report and data tables to the DuPont CRG Project Manager. The approved quality assurance review will be signed and dated by the Environmental Standards Data Validation Task Manager.

9.3 Data Reporting

Data reporting procedures shall be carried out for field and laboratory operations as indicated below:

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and log book notes made in the field.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data (to the US EPA) begins after the internal laboratory validation activity has been concluded. The laboratory Quality Assurance Officer must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. One complete "CLP-like" data package (for all samples) will be delivered to the DuPont CRG Project Manager, and will be made available to the US EPA Region 5 upon request. In addition to the record of Chain-of-Custody, the report format shall consist of the items identified in Table F9-3. Examples of the forms that will be used by Lancaster Laboratories to tabulate the information have been provided in Attachment F15.

TABLE F9-1 DATA VALIDATION SOPS FOR ORGANIC, INORGANIC AND WET CHEMISTRY PARAMETERS

SOP NUMBER	SOP FOR DATA VALIDATION	PARAMETER(S)/PARAMETER GROUP	ANALYTICAL METHOD
DV-GEN-01	General Validation Procedures and Qualifier Codes	General Procedures for all Parameters	NA
DV-GEN-02	Preparation of Written Quality Assurance Reviews to Report Data Validation Results	General Procedures for all Parameters	NA
DV-VOA-01	Validation of Volatile Organic Compound Results Generated by SW-846 Method 8260B	BTEX	SW-846 8260B
DV-BNA-01	Validation of Semivolatile Organic Compound Results Generated by SW-846 Method 8270C	PAHs and Phenols	SW-846 8270C
DV-OCPP-01	Validation of Organochlorine Pesticide/PCB Compound Results Generated by SW-846 Methods 8081A and 8082	Pesticides and PCBs	SW-846 8081A/8082
DV-OCH-01	Validation of Organochlorine Herbicide Compound Results Generated by SW-846 Method 8151A	2,4-D	SW-846 8151A
DV-MET-01	Validation of Metals Data Generated by SW-846 6010B	Metals except Mercury by ICP	SW-846 6010B
DV-MET-02	Validation of Metals Data Generated by SW-846 7000A	Arsenic and Lead by GFAA	SW-846 7000 series
DV-MET-03	Validation of Metals Data Generated by SW-846 7470A/7471A	Mercury and Simultaneously Extracted Mercury	SW-846 7470A/7471A
DV-MET-01	Validation of Metals Data Generated by SW-846 6010B	Simultaneously Extracted Metals Except Mercury	SW-846 6010B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Acid Volatile Sulfides	SW-846 9030B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Cyanide	SW-846 9012A
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Oil & Grease	SW-846 9071A
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Phenolics	SW-846 9065
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Soluble Fluoride, Soluble Sulfate, Nitrate/Nitrite Nitrogen	SW-846 9056
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Sulfide	SW-846 9030B
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Ammonia Nitrogen	EPA 350.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Kjeldahl Nitrogen	EPA 351.2
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Phosphorus	EPA 365.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	pH	SW-846 9045C
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Organic Carbon (Soluble)	EPA 415.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Solids	EPA 160.3
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Grain Size	ASTM D422-63
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Fecal Coliform Bacteria	SM 9221C
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Chemical Oxygen Demand	EPA 410.4
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Biochemical Oxygen Demand	EPA 405.1
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Orthophosphate	EPA 365.3
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Total Suspended Solids	EPA 160.2
DV-WET-01	Validation of Wet Chemistry Data Generated by EPA Methodology	Hardness	EPA 130.2

NOTES:

BTEX - Benzene, Toluene, Ethylbenzene, Xylenes (Total)

TCL - Target Compound List

NA - Not Applicable

ICP - Inductively Couple Plasma

GFAA - Graphite Furnace Atomic Absorption

TABLE F9-2
FORMAT OF ENVIRONMENTAL STANDARDS' QUALITY ASSURANCE REVIEW

TITLE PAGE
TABLE OF CONTENTS
EXECUTIVE SUMMARY
INTRODUCTION AND SAMPLE LISTING

SECTION 1

1. Introduction

The introduction section will briefly state the amount of samples analyzed, who analyzed them, what parameters were analyzed for, and by what methods.

2. Laboratory Compliance

This section will specify any correctable and/or noncorrectable deficiencies and informative comments that were identified relative to the organic, inorganic, and general chemistry requirements specified in the analytical SOPs. Appropriate EPA citations or project citations will be provided for each item listed. This section will also specify discrepancies between the reported data and the raw data.

3. Data Qualifiers

This section will present qualifiers that should be considered in order for the data to best be utilized, including a detailed assessment of the degree to which data have been compromised by any deviation from protocol (i.e., lack of analytical control and QC failure). For every statement made in this section, there is a subsequent finding that justifies the qualifying statement. These qualifiers/findings are presented as bulleted items in order of importance relative to their impact on the data set. The data qualifiers will be presented in two subsections; organic data and inorganic and general chemistry data. Within each subsection the qualifiers will be presented in the order of greatest impact to least impact.

SECTION 2

This section will include the qualified sample result summaries, including a glossary defining the qualifier codes. These qualified spreadsheets will be presented in the order of BTEX, PAHs/phenols, pesticides, PCBs, herbicides, metals, and general chemistry parameters.

SECTION 3

The organic quality assurance review is fully supported by a documentation appendix. For every qualifier made in the report, there is a photocopied page of laboratory data that is used in support of the reviewer's comments. All QC summary forms as well as the reviewer's worksheets are presented in the support documentation.

SECTION 4

The inorganic and general chemistry quality assurance review is also fully supported by a documentation appendix in the same format as the organic data. All QC summary forms as well as the reviewer's worksheets are presented in the support documentation.

SECTION 5

This section of the quality assurance review will contain the laboratory case narratives and the field and laboratory Chains-of-Custody Records.

SECTION 6

This section of the quality assurance review will any applicable project correspondence.

TABLE F9-3
LABORATORY DATA PACKAGE DELIVERABLES

1. Case Narrative:

   i. Date of issuance
   ii. Laboratory analysis performed
   iii. Any deviations from intended analytical strategy
   iv. Laboratory batch number
   v. Numbers of samples and respective matrices
   vi. Quality control procedures utilized and also references to the acceptance criteria
   vii. Laboratory report contents
   viii. Project name and number
   ix. Condition of samples 'as-received'
   x. Discussion of whether or not sample holding times were met
   xi. Discussion of technical problems or other observations which may have created analytical difficulties
   xii. Discussion of any laboratory quality control checks which failed to meet project criteria
   xiii. Signature of the laboratory Quality Assurance Officer

2. Chemistry Data Package

   i. Case narrative for each analyzed batch of samples
   ii. Summary page indicating dates of analyses for samples and laboratory quality control checks
   iii. Cross-referencing of laboratory sample to project sample identification numbers
   iv. Data qualifiers to be used should be adequately described
   v. Sample preparation and analyses logs for samples
   vi. Sample results
   vii. Raw data for sample results and laboratory quality control samples
   viii. Results of (dated) initial and continuing calibrations checks, GC/MS tuning results, and analyte breakdown checks
   ix. Matrix spike and matrix spike duplicate recoveries, laboratory control samples, method blank results, surrogate compound results, and internal standard results
   x. Labeled (and dated) chromatograms/spectra of sample results and laboratory quality control checks
   xi. Results of ICP interference checks, post-digestion spikes, and serial dilution analyses
   xii. ICP instrument detection limits, linear ranges, and interelement correction factors

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

10.1 Field Performance and System Audits

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the DuPont CRG Field Team Leader.

10.1.1.2 Internal Field Audit Frequency

These audits will verify that all established procedures are being followed. An internal field audit will be conducted at least once at the beginning of each site sample collection activity (surface sediment sampling, shallow core sampling, deep core sampling, wetlands sediment sampling, and surface water sampling).

10.1.1.3 Internal Field Audit Procedures

The audit will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, Chain-of-Custody, etc. Follow-up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the SCS. The audit will involve review of field measurement records, instrumentation calibration records, and sample documentation. The field audit checklist to be used for this project is submitted as Attachment F16 to this QAPP.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

External field audits may be conducted by the US EPA Region 5 Project Coordinator.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the US EPA.

10.1.2.3 Overview of the External Field Audit Process

External field audits will be conducted according to the field activity information defined in the QAPP and FSP.

10.2 Laboratory Performance and Systems Audits

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Laboratory Audit Responsibilities

Internal laboratory audits will be conducted by each laboratory's QA Officer or designate.

10.2.1.2 Internal Laboratory Audit Frequency

Lancaster Laboratories performs internal laboratory system audits twice per year. NET performs internal system audits on a monthly basis in the various laboratory departments including, but not limited to, bacteriology, wet chemistry, reporting, customer service, and administration. With regard to laboratory performance audits, both laboratories participate in various performance evaluation (PE) audit programs including, but not limited to, internal programs, US EPA water pollution (WP) PEs, and US EPA Water

Supply (WS) PEs. Each of these programs are conducted at various frequencies (generally annually or semi-annually) throughout the year.

10.2.1.3 Internal Laboratory Audit Procedures

The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, Chain-of-Custody procedures, sample preparation and analysis, instrument operating records, etc. Each laboratory's QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance. The Lancaster Laboratories and NET laboratory audit checklists have been included as Attachments F17 and F18, respectively.

10.2.2 External Laboratory Audits

10.2.2.1 External Laboratory Audit Responsibilities

An external audit may be conducted by US EPA Region 5 Central Regional Laboratory (CRL).

10.2.2.2 External Laboratory Audit Frequency

An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the US EPA.

10.2.2.3 Overview of the External Laboratory Audit Process

External laboratory audits may include (but may not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

SECTION 11

PREVENTATIVE MAINTENANCE

Preventative maintenance of laboratory and field equipment is essential to obtaining accurate data. Unnecessary resampling and analysis can be avoided if equipment is well maintained.

11.1 Field Instrument Preventative Maintenance

The field equipment for this project includes thermometers, pH meters, conductivity meters, and dissolved oxygen meters. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. The details of all preventative maintenance will be recorded in the Field Logbook each time that it is performed. Critical spare parts such as tape, pH probes, and batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule. Field equipment routine daily maintenance will include, but is not limited to:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems;
- Decontamination of the sampling equipment and measurement systems before and after use;
- Daily inspections of sampling equipment and measurement systems for possible problems (e.g., cracked or clogged lines or tubing or weak batteries);
- Checking instrument calibrations as described in Section 6.1 of this QAPP; and
- Charging any battery packs for equipment when not in use.

11.2 Laboratory Instrument Preventative Maintenance

As part of their QA/QC program, a routine preventative maintenance program is conducted by each project laboratory to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees shall regularly perform routine scheduled maintenance and repair of (or to coordinate with the vendor for the repair of) all instruments. Every time any maintenance is performed, it is documented in the laboratory's applicable maintenance record books. The record of maintenance includes, at a minimum, actions taken, parts replaced, analysts' initials, and the date the maintenance was performed, whether by the

analyst or a contracted service representative. Laboratory instruments are maintained in accordance with manufacturer's specification. Table F11-1 provides the frequency which components of key analytical instruments or equipment will be serviced. The laboratories will maintain a complete inventory of replacement parts needed for preventative maintenance and spare parts that routinely need replacement (e.g., septa, gauges, sources, and detectors). If an instrument fails, the problem will be diagnosed as quickly as possible, and either replacement parts will be ordered or a service call will be place to the manufacturer.

Table F11-1

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
GC/MS	Change septum	Weekly or AN*
	Check fans	Monthly
	Check cool flow	Monthly
	Clean source	Bimonthly or AN
	Change oil in vacuum pump	Semiannually
	Change oil in turbo pump	Semiannually
GC	Septum change	Each run
	Column maintenance	AN
	Clean detector	AN
	Vacuum filters	Semiannually
	Leak check ECDs	Semiannually
GFAA	Rinse workhead assembly	Weekly
	Clean windows	Weekly
	Replace probe tubing	AN
	Check rinse bottle & drain	Daily
Cold Vapor AA	Change drying tube	Daily
	Replace pump tubing	AN: Min. weekly
	Lubricate pump head	Weekly
	Lubricate autosampler	Weekly
	Inspect optical cell and windows	Monthly
	Clean	AN
ICP	Clean torch	AN
	Clean nebulizer & spray chamber	AN
	Replace pump winding	Check Daily
	Lubricate autosampler	Check Daily
	Check mirror	Daily
	Checking tubing to torch	Daily
	Check fan filters, clean if needed	Weekly
	Check cool flow, clean if needed	Weekly
	Check water filter, replace if needed	Quarterly

Table F11-1

Preventive Maintenance Schedule

Instrument	Preventive Maintenance	Frequency
Autoanalyzer	Clean sample probe	AN
	Clean proportioning pump	Weekly
	Inspect pump tubing, replace if worn	AN
	Clean wash receptacles	Monthly
	Inspect condition of distillation head	Monthly
Total Organic Carbon Analyzer	Check IR zero	AN
	Check for leaks	AN
	Check acid pump calib.	Bimonthly
	Check persulfate pump calibration	Bimonthly
	Inspect 6-port rotary valve	AN
	Inspect sample pump head	AN
	Wash molecular sieve	AN
	Check sample loop calibration	Monthly
	Clean gas permeation tube	AN
	Inspect digestion vessel O-rings	AN
	Check activated carbon scrubber	AN
	Dust back and clean circuit boards	AN
	Check IR cell	AN

* AN means as needed. Any of these items may be performed more frequently if response during operation indicates this is necessary.

SECTION 12

SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

12.1 Accuracy Assessment

Accuracy is defined as the nearness of a result or the mean of a set of results to the true value. In order to assure proper accuracy of the analytical procedures, environmental samples will be designated for the laboratory to spike with a known amount of the analyte or analytes to be evaluated. In general, a sample spike should be included in every set of 20 samples of the same matrix. The spike sample is then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte and compared to the reported value of the same analyte in the unspiked sample, determines the percent recovery. The laboratory then compares the percent recoveries to the control limits, which are listed in Attachment F1, Table FA1-3, of this QAPP. The analyst is responsible for this comparison and applies appropriate corrective action as needed. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%\text{Recovered} = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample})}{\text{Known Amount Added}} \times 100\% \qquad \text{(Eq. 1)}$$

In addition to a spiking program, samples, standards, and blanks subject to organic analyses will be spiked with surrogate compounds. Laboratory performance on individual samples will be established by the recovery of surrogate compounds.

12.2 Precision Assessment

Precision is defined as the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analyses. Spiked samples are prepared at the laboratory from designated samples, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. For some analyses, duplicate samples are prepared at the laboratory from designated samples by just dividing the sample into equal aliquots. The duplicate spiked samples and/or the duplicate samples are then included in the analytical sample set. This allows the analyst to determine the precision of the preparation

and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the duplicate spiked samples and/or the duplicate samples are calculated. The laboratory then compares the RPDs to the control limits, which are listed in Attachment F1, Table FA1-3, of this QAPP. The analyst is responsible for this comparison and applies appropriate corrective action as needed. The RPD is calculated according to the following formula:

$$RPD = \frac{|D_2 - D_1|}{0.5\,(D_1 + D_2)} \times 100\%$$

where: D_1 is defined as the first subsample value (or % recovery for spiked sample)
D_2 is defined as the second subsample value (or % recovery for spiked sample)

(Eq. 2)

In addition to evaluation of the method precision, duplicate samples will be collected in the field and analyzed independently. The results will be used to evaluate the total system's variability, including sampling variations. The analytical precision produced by laboratory replicate analyses will be evaluated by both the laboratory and Environmental Standards, while field duplicate will be evaluated only by Environmental Standards. Evaluation of both types of data will be in accordance with the references methods in this QAPP.

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing and the independent data review, the percent completeness will be calculated by the following equation:

$$\% \text{ Completeness} = \frac{\text{Usable Data}}{\text{Total Data Generated}} \times 100\%$$

where: Usable Data is defined as all results that are not rejected in the data validation process.
Total Data Generated is defined as all data that is possible based on the number of samples collected for analysis.

(Eq. 3)

The percent completeness will be used to determine whether the data quality meets the objectives for the project.

SECTION 13

CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or poor QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the DuPont CRG Project Manager, or his designee. If immediate corrective action is required, approvals secured by telephone from the DuPont CRG Project Manager should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the DuPont CRG Project Manager, who in turn will notify the US EPA RCRA Project Coordinator. If the problem is analytical in nature, information on these problems will be promptly communicated to the US EPA Region 5. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. The DuPont CRG Project Manager, or his designee, will issue a nonconformance report for each nonconformance condition.

13.1 Field Corrective Action

Corrective action in the field can be needed when the sample network is changed (i.e. more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. In general, the field team (technician, DuPont CRG Field Team Leader, DuPont CRG Project Manager, DuPont CRG QA Manager, and DuPont CRG Project QA Manager) may identify the need for corrective action. The field staff in consultation with the DuPont CRG Field Team Leader will recommend a corrective action. The DuPont CRG Project Manager will approve the corrective measure which will be implemented by the field team. It will be the responsibility of the DuPont CRG Field Team Leader to ensure the corrective action has been implemented.

If the corrective action will supplement the existing sampling plan (i.e. additional sediment core samples) using existing and approved procedures in the QAPP, corrective action approved by the DuPont CRG Field Team Leader will be documented. If corrective actions resulting in fewer samples (or analytical fractions), alternate locations, etc. keep project quality assurance objectives from being achieved, it will be necessary that all levels of project management, including the DuPont CRG Project Manager and the US EPA RCRA Project Coordinator, concur with the proposed action.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The DuPont CRG Project QA Manager will identify deficiencies and recommended corrective action to the DuPont CRG Project Manager. Implementation of corrective actions will be performed by the DuPont CRG Field Team Leader and field team. Corrective action will be documented in quality assurance reports to the entire project management team.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the US EPA RCRA Project Coordinator.

13.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during and after initial analyses. Each laboratory's corrective action procedures are provided throughout the SOPs provided in Attachments F2 - F11. The submitted SOPs specify the majority of the conditions during or after analysis that automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, or automatic reinjection/reanalysis when certain QC criteria are not met. Furthermore, a number of conditions, such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples, may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts, it may be necessary for the laboratory QA Officer to approve the implementation of corrective action.

A member of the laboratory technical staff will identify the need for corrective action. The laboratory QA Officer, in consultation with members of the technical staff, will approve the required corrective action to be implemented by designated members of the laboratory technical staff. The laboratory QA Officer will also ensure implementation and documentation

of the corrective action. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform all levels of project management, including the US EPA RCRA Project Coordinator, to concur with the corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented on a laboratory corrective action log, and the narrative data report sent from the laboratory to the Environmental Standards data validator. If corrective action does not rectify the situation, the laboratory Project Manager will contact the DuPont CRG Project Manager.

13.3 Corrective Action During Data Validation and Data Assessment

The need for corrective action may be identified during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

As previously stated in Section 12.3, the percent completeness will be used to determine whether the data quality meets the objectives for the project. If the completeness objectives are not met for individual parameters, the reasons for the invalid data will be reviewed by DuPont. Depending on the ability to mobilize the field team, the reasons for the incomplete data (e.g., holding time exceeded), and the effect of the incomplete data on the accomplishment of the project objectives, additional samples may be collected and analyzed. An evaluation will also be conducted if a sample does not generate data for a parameter category (e.g., volatile organic constituents, metals). Such a data gap could result from sample container breakage or loss of or sample custody not being maintained. If DuPont determines that the missing results are critical to accomplishing the work plan objectives, additional sampling will be conducted to obtain the missing data. The DuPont CRG Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the DuPont CRG Project QA Manager.

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The deliverables associated with the tasks identified in the SCS Workplan and bimonthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. These reports will be the responsibility of the DuPont CRG Project Manager and will include the DuPont CRG Project QA Manager report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project. The Environmental Standards Data Validation Task Manager will provide the DuPont CRG Project QA Manager with the accuracy and precision assessment for this purpose.

14.1 Contents of Project QA Reports

The QA reports will contain, on a routine basis, all results of any field and laboratory audits performed during the past two months, all information generated during the past two months reflecting on the achievement of specific DQOs (including data validation and assessment results), and a summary of corrective action that was implemented and its immediate results on the project. The status of analytical and data validation tasks will be summarized for the project with respect to the Project Schedule included in Figure 5-3 of the SCS Work Plan. Based on this information, the QA reports will also include an indication of whether the QA objectives were met and limitations on the reported data. In addition, whenever necessary, updates on training provided, changes in key personnel, and anticipated problems in the field or laboratory for the coming two months that could bear on data quality along with proposed solutions will be reported. Furthermore, detailed references to QAPP modifications will also be highlighted. All QA reports will be prepared in written, final format by the DuPont CRG Project Manager, or his designee.

14.2 Frequency of QA Reports

The QA Reports will be prepared on a bimonthly basis and will be delivered to all recipients by the 10^{th} of every other month. The reports will continue without interruption until the project has been completed. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. These events and their resolution will be addressed thoroughly in the next issue of the bimonthly QA report.

14.3 Individuals Receiving/Reviewing QA Reports

Those individuals identified in the List of QAPP recipients will receive copies of the bimonthly QA report. The QA Reports will be submitted to the US EPA Region 5 and IDEM with the bimonthly progress reports discussed in Section 5.5.1 of the SCS Work Plan.

ATTACHMENT F1

DATA QUALITY OBJECTIVES

TABLE FA1-1: DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

DQO Parameter	Aqueous Criteria	Sediment/Solid Criteria
Precision	Table FA1-2 and Table FA1-3	Table FA1-2 and Table FA1-3
Accuracy	Tables FA1-2, FA1-3, and FA1-4	Tables FA1-2, FA1-3, and FA1-4
Sensitivity	Table F1-1	Table F1-1
Representativeness (Field Duplicates)	The RPD between the results of aqueous field duplicates should be less than or equal to 20% for results greater than 5 X the PQL. The difference between results in aqueous field duplicates should be less than the PQL when at least one result is less than or equal to 5X the PQL.	The RPD between the results of sediment/solid field duplicates should be less than or equal to 40% for results greater than 5 X the PQL. The difference between results in sediment/solid field duplicates should be less than 2X the PQL when at least one result is less than or equal to 5X the PQL.
Completeness	90% for field data 95% for laboratory data	90% for field data 95% for laboratory data
Comparability	Based on Precision and Accuracy and Media Comparison	Based on Precision and Accuracy and Media Comparison

NOTES: DQO = Data Quality Objective. RPD = Relative Percent Difference. PQL = Practical Quantitation Limit.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
BTEX	Lab blank, trip blank, or equipment blank	All BTEX Compounds	< the PQL for all BTEX Compounds	< the PQL for all BTEX Compounds
	Matrix Spike Duplicate Precision	All BTEX Compounds	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All BTEX Compounds	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All BTEX Compounds	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	4-Bromoflurobenzene	86-115%	74-121%
		1,2-Dichloroethane-d_4	80-120%	80-120%
		Toluene-d_8	88-110%	81-117%
		Dibromofluoromethane	86-118%	80-120%
PAHs and Phenols	Lab blank or equipment blank	All PAHs and Phenols	< the PQL for all PAHs and Phenols	< the PQL for all PAHs and Phenols
	Matrix Spike Duplicate Precision	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All PAHs and Phenols	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	Nitrobenzene-d_5	47-114%	31-126%
		2-Fluorobiphenyl	51-106%	45-113%
		p-Terphenyl-d_{14}	37-119%	37-130%
		Phenol-d_6	7-74%	39-108%
		2-Fluorophenol	25-88%	35-108%
		2,4,6-Tribromophenol	34-125%	23-125%

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
Pesticides Compounds	Lab blank or equipment blank	All Pesticides	< PQL for all pesticides	< PQL for all pesticides
	Matrix Spike Duplicate Precision	All Pesticides	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Pesticides	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Pesticides	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	tetrachloro-*meta*-xylene decachlorobiphenyl	60-120% 60-120%	50-120% 50-120%
PCBs	Lab blank or equipment blank	All PCBs	< PQL for PCBs	< PQL for PCBs
	Matrix Spike Duplicate Precision	All PCBs	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All PCBs	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All PCBs	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	tetrachloro-*meta*-xylene decachlorobiphenyl	60-120% 60-120%	50-120% 50-120%

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-2: ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

DUPONT - EAST CHICAGO IN
SCS QAPP

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
Organochorine Herbicide	Lab blank or equipment blank	2,4-D	< PQL for 2,4-D	< PQL for 2,4-D
	Matrix Spike Duplicate Precision	2,4-D	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	2,4-D	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	2,4-D	Table FA1-3	Table FA1-3
	Surrogate Spike Recoveries	DCAA	60-120%	50-120%
Metals and Simultaneously Extracted Metals (SEM)	Lab blank or equipment blank	All Metals	< PQL for all metals	< PQL for all metals
	Laboratory Duplicate Precision	All Metals	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Metals	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Metals	Table FA1-3	Table FA1-3
All Wet Chemistry Parameters	Lab blank or equipment blank	All Parameters	< PQL for all parameters	< PQL for all parameters
	Laboratory Duplicate Precision	All Parameters	Table FA1-3	Table FA1-3
	Matrix Spike Recovery	All Parameters	Table FA1-3	Table FA1-3
	Laboratory Control Sample Recovery	All Parameters	Table FA1-3	Table FA1-3

NOTE: PQL = Practical Quantitation Limit. NA = Not applicable.

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
BTEX								
71-43-2	Benzene	SW-846 8260B	NA	NA	82-123	76-128	30	77-126
100-41-4	Ethylbenzene	SW-846 8260B	NA	NA	89-124	77-138	30	86-129
108-88-3	Toluene	SW-846 8260B	NA	NA	80-126	69-140	30	74-128
1330-20-7	Xylenes (total)	SW-846 8260B	NA	NA	89-123	83-135	30	88-128
Polycyclic Aromatic Hydrocarbons (PAHs) and Phenols								
83-32-9	Acenaphthene	SW-846 8270C	NA	NA	61-100	47-114	30	61-100
208-96-8	Acenaphthylene	SW-846 8270C	NA	NA	64-100	42-119	30	62-101
120-12-7	Anthracene	SW-846 8270C	NA	NA	66-101	42-119	30	62-105
56-55-3	Benzo[a]anthracene	SW-846 8270C	NA	NA	69-101	33-135	30	63-106
205-99-2	Benzo[b]fluoranthene	SW-846 8270C	NA	NA	64-101	24-148	30	59-105
207-08-9	Benzo[k]fluoranthene	SW-846 8270C	NA	NA	67-105	41-126	30	63-108
191-24-2	Benzo[ghi]perylene	SW-846 8270C	NA	NA	55-115	12-133	30	52-113
50-32-8	Benzo[a]pyrene	SW-846 8270C	NA	NA	65-101	21-139	30	61-107
59-50-7	4-Chloro-3-methylphenol	SW-846 8270C	NA	NA	60-111	22-142	30	56-108
95-57-8	2-Chlorophenol	SW-846 8270C	NA	NA	62-107	36-124	30	55-107
218-01-9	Chrysene	SW-846 8270C	NA	NA	67-101	9-153	30	60-107
132-64-9	Dibenzofuran	SW-846 8270C	NA	NA	67-99	38-120	30	62-102
53-70-3	Dibenz[a,h]anthracene	SW-846 8270C	NA	NA	66-117	11-152	30	60-117
120-83-2	2,4-Dichlorophenol	SW-846 8270C	NA	NA	65-98	39-135	30	59-100
105-67-9	2,4-Dimethylphenol	SW-846 8270C	NA	NA	52-99	32-119	30	39-108
534-52-1	4,6-Dinitro-2-methylphenol	SW-846 8270C	NA	NA	43-120	5-128	30	42-107
51-28-5	2,4-Dinitrophenol	SW-846 8270C	NA	NA	25-124	1-126	30	29-117
206-44-0	Fluoranthene	SW-846 8270C	NA	NA	66-106	26-137	30	58-110
86-73-7	Fluorene	SW-846 8270C	NA	NA	61-108	59-121	30	59-109
193-39-5	Indeno[1,2,3-cd]pyrene	SW-846 8270C	NA	NA	59-111	28-127	30	55-111
78-59-1	Isophorone	SW-846 8270C	NA	NA	66-113	46-127	30	57-114
91-57-6	2-Methylnaphthalene	SW-846 8270C	NA	NA	62-98	45-112	30	60-102
95-48-7	2-Methylphenol	SW-846 8270C	NA	NA	55-96	20-130	30	37-101
65794969	3 or 4-Methylphenol	SW-846 8270C	NA	NA	48-99	22-138	30	48-116
91-20-3	Naphthalene	SW-846 8270C	NA	NA	60-97	50-106	30	58-99
88-75-5	2-Nitrophenol	SW-846 8270C	NA	NA	67-104	40-125	30	59-107
100-02-7	4-Nitrophenol	SW-846 8270C	NA	NA	Mar-83	5-132	30	44-110
87-86-5	Pentachlorophenol	SW-846 8270C	NA	NA	46-114	14-131	30	42-108
85-01-8	Phenanthrene	SW-846 8270C	NA	NA	68-102	54-120	30	62-107
108-95-2	Phenol	SW-846 8270C	NA	NA	30437	29-112	30	49-105
129-00-0	Pyrene	SW-846 8270C	NA	NA	58-112	52-115	30	52-115
95-95-4	2,4,5-Trichlorophenol	SW-846 8270C	NA	NA	67-103	18-139	30	63-107
88-06-2	2,4,6-Trichlorophenol	SW-846 8270C	NA	NA	66-105	37-127	30	62-106

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Organochlorine Pesticides								
309-00-2	Aldrin	SW-846 8081A	NA	NA	41-115	49-145	50	49-145
319-84-6	alpha-BHC	SW-846 8081A	NA	NA	60-133	48-144	50	48-144
319-85-7	*beta*-BHC	SW-846 8081A	NA	NA	64-122	34-145	50	34-145
319-86-8	*delta*-BHC	SW-846 8081A	NA	NA	64-132	51-142	50	44-145
58-89-9	*gamma*-BHC/Lindane	SW-846 8081A	NA	NA	62-132	51-142	50	51-142
72-54-8	4,4'-DDD	SW-846 8081A	NA	NA	60-134	53-141	50	53-141
72-55-9	4,4'-DDE	SW-846 8081A	NA	NA	55-126	61-135	50	61-135
50-29-3	4,4'-DDT	SW-846 8081A	NA	NA	59-135	60-138	50	60-138
60-57-1	Dieldrin	SW-846 8081A	NA	NA	61-122	59-130	50	59-130
959-98-8	Endosulfan I	SW-846 8081A	NA	NA	45-132	46-135	50	46-135
33213-65-9	Endosulfan II	SW-846 8081A	NA	NA	52-130	48-132	50	48-132
1031-07-8	Endosulfan sulfate	SW-846 8081A	NA	NA	67-132	40-150	50	40-150
72-20-8	Endrin	SW-846 8081A	NA	NA	68-148	69-152	50	69-152
7421-93-4	Endrin aldehyde	SW-846 8081A	NA	NA	52-142	28-166	50	28-166
76-44-8	Heptachlor	SW-846 8081A	NA	NA	46-120	60-137	50	60-137
1024-57-3	Heptachlor epoxide	SW-846 8081A	NA	NA	64-126	59-136	50	59-136
72-43-5	Methoxychlor	SW-846 8081A	NA	NA	60-164	52-174	50	52-174
8001-35-2	Toxaphene	SW-846 8081A	NA	NA	NA	NA	NA	NA
5103-71-9	*alpha*-Chlordane	SW-846 8081A	NA	NA	67-124	70-134	50	70-134
5103-74-2	*gamma*-Chlordane	SW-846 8081A	NA	NA	63-114	65-125	50	65-125
53494-70-5	Endrin ketone	SW-846 8081A	NA	NA	69-121	53-135	50	53-135
PCBs								
12674-11-2	Aroclor-1016	SW-846 8082	NA	NA	43-126	64-127	50	64-127
11104-28-2	Aroclor-1221	SW-846 8082	NA	NA	NA	NA	NA	NA
11141-16-5	Aroclor-1232	SW-846 8082	NA	NA	NA	NA	NA	NA
53469-21-9	Aroclor-1242	SW-846 8082	NA	NA	NA	NA	NA	NA
12672-29-6	Aroclor-1248	SW-846 8082	NA	NA	NA	NA	NA	NA
11097-69-1	Aroclor-1254	SW-846 8082	NA	NA	NA	NA	NA	NA
11096-82-5	Aroclor-1260	SW-846 8082	NA	NA	51-126	69-123	50	69-123
Organochlorine Herbicide 2,4-D								
94-75-7	2,4-D	SW-846 8082	NA	NA	52-141	58-147	50	58-147

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Metals								
7440-36-0	Antimony	SW-846 6010B	80-120	20	80-120	80-120	20	19-213
7440-38-2	Arsenic	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	71-129
7440-43-9	Cadmium	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	75-125
7440-47-3	Chromium	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	78-123
7440-50-8	Copper	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	80-120
7439-92-1	Lead	SW-846 6010B/7000A	80-120	20	80-120	80-120	20	67-133
7439-95-4	Magnesium	SW-846 6010B	NA	NA	80-120	80-120	20	69-132
7439-97-6	Mercury	SW-846 7470A/7471A	80-120	20	80-120	80-120	20	62-138
7439-95-4	Molybdenum	SW-846 6010A	NA	NA	80-120	80-120	20	73-127
7440-02-0	Nickel	SW-846 6010B	80-120	20	80-120	80-120	20	75-125
7440-22-4	Silver	SW-846 6010B	NA	NA	80-120	80-120	20	72-128
7440-62-2	Vanadium	SW-846 6010B	NA	NA	80-120	80-120	20	64-136
7440-66-6	Zinc	SW-846 6010B	80-120	20	80-120	80-120	20	74-126
Simultaneously Extracted Metals								
7440-38-2	Arsenic	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-43-9	Cadmium	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-47-3	Chromium	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7440-50-8	Copper	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7439-92-1	Lead	SW-846 6010B/7000A	NA	NA	80-120	80-120	20	80-120%
7439-97-6	Mercury	SW846-7470A	NA	NA	80-120	80-120	20	80-120%
7440-02-0	Nickel	SW846-6010B	NA	NA	80-120	80-120	20	80-120%
7440-66-6	Zinc	SW846-6010B	NA	NA	80-120	80-120	20	80-120%

TABLE FA1-3: MATRIX SPIKE AND LCS PRECISION AND ACCURACY OBJECTIVES
DUPONT - EAST CHICAGO IN
SCS QAPP (2), (3)

			AQUEOUS			SEDIMENT		
CAS#(1)	Analyte Name	Method	MS/MSD Recovery	MS/MSD or LD RPD	LCS % Recovery	MS/MSD % Recovery	MS/MSD or LD %RPD	LCS % Recovery
Wet Chemistry								
EVS-0162	Acid Volatile Sulfides	SW-846 9030B	NA	NA	80-120	75-125	20	80-120
57-12-7	Cyanide, Total	SW846 9012A	NA	NA	80-120	44-146	44	90-110
C-007	Oil & Grease	SW-846 9071A	64-122	2500	66-104	45-148	20	88-108
C-020	Phenolics	SW-846 9065	53-126	1900	73-115	41-139	23	70-116
16984-48-8	Soluble Fluoride	SW-846 9056	NA	NA	84-105	70-117	20	78-107
14808-79-8	Soluble Sulfate	SW-846 9056	NA	NA	90-110	75-125	20	90-110
18496-25-8	Total Sulfide	SW-846 9030B	NA	NA	85-110	60-99	56	76-107
7664-41-7	Ammonia Nitrogen	EPA 350.1/350.2	46-132	700	84-116	31-145	10	80-120
C-021	Total Kjeldahl Nitrogen	EPA 351.2	40-182	1400	82-125	24-142	20	28-134
7723-14-0	Total Phosphorus	EPA 365.1	64-126	700	86-114	29-166	20	80-114
C-006	pH	SW-846 9045C	NA	NA	97-103	NA	5	97-103
C-012	Total Organic Carbon	EPA 415.1	NA	NA	85-115	75-125	20	82-120
C-008	Total Solids	EPA 160.3	NA	NA	86-114	NA	13	99-101
(4)	Grain Size	ASTM D422-63	NA	NA	NA	NA	NA	NA
U-004	Fecal Coliform Bacteria	SM 9221C	NA	20	NA	NA	NA	NA
C-004	Chemical Oxygen Demand	EPA 410.4	82-114	600	93-105	NA	NA	NA
C-002	Biochemical Oxygen Demand	EPA 405.1	NA	20	NA	NA	NA	NA
C-005	Nitrate/Nitrite Nitrogen	SW-846 9056	70-130 nitrite 62-133 nitrate	8 nitrite 7 nitrate	85-115 nitrite 89-111 nitrate	NA	NA	NA
14265-44-2	Orthophosphate	EPA 365.2	75-125	20	NA	NA	NA	NA
C-009	Total Suspended Solids	EPA 160.2	NA	2100%	67-118	NA	NA	NA
471341	Hardness	EPA 130.2	81 -116	300%	93-107	NA	NA	NA

NOTES:

(1) The CAS # is fictitious for the combined 3- or 4-Methylphenol and for Wet Chemistry parameters which do not have true CAS #s.
(2) NA - Not Applicable.
(3) MS - Matrix Spike. MSD - Matrix Spike Duplicate. LD - Laboratory Duplicate. LCS - Laboratory Control Sample.
(4) Grain size will be reported by the percent in certain mm sieve. Therefore, a CAS# is not applicable to grain size.

TABLE FA1-4: DATA QUALITY OBJECTIVES FOR FIELD PARAMETERS DUPONT - EAST CHICAGO, IN SCS QAPP

Field Parameter	Audit	Frequency	Control Limits
pH	Duplicate	Once per 20 samples or every day, whichever is more frequent.	
	Control Sample (different buffer than the initial calibration)	Once per 20 samples or every day, whichever is more frequent.	
Specific Conductivity	Blank	Once every day.	
	Duplicate	Once per 20 samples or every day, whichever is more frequent.	
	Idependently-prepared Control Standard	Once every day.	
Dissolved Oxygen	Duplicate	Once per 20 samples or every day, whichever is more frequent.	
	Control Standard	Once every day.	

ATTACHMENT F2

LANCASTER LABORATORIES VOLATILES PREPARATION AND ANALYSIS SOPS

SOP Number	Lancaster Laboratories Header Number	Title
AL-VOA-01	8389, 8390	Preparation of Soils for Volatile Analysis by EPA SW-846 Method 5035
AL-VOA-02	5243, 5244, 5382, 5383, 6291, 6872, 6873, 6886, 6887, 7582	Waters and Wastewaters for Volatile Target Compounds by Gas Chromatography/Mass Spectroscopy (GC/MS): Capillary Column Technique
AL-VOA-03	5441, 5442, 6292, 7584, 7720, 7721	Soils and solids for Volatile Target Compounds by Gas Chromatography/Mass Spectroscopy (GC/MS): Capillary Column Technique